PREFACE

Annual Report (2013), Part I – Kharif 2013, embodies the results of various research trials conducted with the view to test and develop technologies for augmenting forage resources in the country. The breeder seed produced against the DAC indent is also compiled and reported.

Results have been presented in the form of chapters. The results of forage crop improvement trials is given in Chapter 1, which includes multi- location test performance of newly developed genetic material in annual and perennial forage species. The findings on crop production studies are presented in Chapter-2 which includes development of technologies in different agro-climatic conditions as well as in national perspective. Chapter-3 deals with different aspects of plant protection in selected forage species, *viz.,* maize, pearl millet, cowpea, rice bean *etc.* and generation of technologies for pest management in the selected crops. Chapter-4 provides Breeder Seed Production status crop-wise and state-wise. Other chapters include details of in-house research activities, weather details and other activities *etc.*

The contribution and sincere efforts made by each and every member of the team at the coordinating and cooperating centers deserve appreciation in achieving the objectives of the project. Their valuable contribution for over all outputs of AICRP on Forage Crops is gratefully acknowledged.

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Dated: February 15, 2014 — *A. K. Roy*

Place: Jhansi — Project Coordinator

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EXECUTIVE SUMMARY

The present report deals with the result of the coordinated trials conducted in different forage crops during Kharif 2013 at different locations/centers in the country placed in five zones *viz*., Hill, North-West, North-East, Central and South Zone under the programme of Crop Improvement, Crop Production and Crop Protection. Breeder Seed Production report from different producing centers is also included. Weather data are also reported to correlate the growth and yield of forage crops as well as incidence of pest and diseases with weather parameters at different sites during crop growth period. The report also includes the other major activities undertaken by different centers.

A. FORAGE CROP IMPROVEMENT

In Kharif 2013, 14 breeding trials of seven annual and seven perennial forage species including test entries with their respective national and zonal checks were conducted at 38 centres located in five zones. The forage species evaluated were Maize, Pearl millet, Cowpea, Rice bean in annuals and *Lasiurus sindicus, Cenchrus setigerus*, Sehima, *Dichanthium, Cenchrus ciliaris, Clitoria ternatea* and Bajra Napier hybrid in perennials.

Trials were classified into three groups *viz*., Initial Varietal Trial (IVT), Advanced Varietal Trial Stage-1 (AVT-1) and Advanced Varietal Trial Stage-2 (AVT-2). Perennial trials were grouped as VT and are being carried out for 3 to 4 years.

The summarized results of different cultivated annual and perennial forage evaluation trials are as below:

ANNUAL FORAGES

MAIZE

In **IVT in Forage Maize,** Six entries along with two national checks were evaluated at 22 locations. For GFY, entry AFM-2 in Hill zone, entries AFM-3, AFM-1, PFM-7 and AFM-2 in North West zone, entry AFM-3 in North East zone exhibited superiority. However in other zones, African Tall maintained superiority. For DMY, entry AFM-2 in Hill zone; entries AFM-3, PFM-7, AFM-2 and AFM-1 in North West zone; entry AFM-3 in North East Zone; entries AFM-3 in Central zone exhibited superiority. At national level, entry AFM-3 ranked first for this character. In Quality parameters, entry AFM-3 ranked first for CPY as well as for Crude protein %.

In **AVT-1 in Forage Hybrid Maize,** Four entries along with two national checks were evaluated at ten locations. For the character GFY, entries PMH-3 and DHM-117 in Hill zone; entry IHTFM in North West zone; entries IHTFM, PMH-1, DHM-117 and PMH-3 in North East zone exhibited their superiority whereas at national level entry IHTFM ranked first for this character. Similarly for DMY, entry PMH-3 in Hill zone; entry IHTFM in North West zone; entries IHTFM PMH-1, DHM-117 and PMH-3 in North East zone exhibited superiority. While, at national level, entry IHTFM ranked first. For fodder production potential, entry IHTFM was superior both for green forage and dry matter production potential. For plant height and leaf stem ratio, national check African Tall established superiority.

PEARL MILLET

In **IVT in Pearl Millet,** Five entries and three national checks were evaluated at 18 locations. For GFY, entries DFMH-30, NDFB-939 and AFB-9 in North West zone; entry NDFB-939 in North East zone exhibited superiority. At national level, entry DFMH-30 with 8.9 per cent superiority was best performer. For DMY, entries NDFB-939, AFB-9 and DFMH-30 in North West zone; entries AFB-9 and NDFB-939 in North East zone and DFMH-30 in South zone exhibited their superiority. At national level, DFMH-30 was best performer, followed by AFB-9 and NDFB-939.

For fodder production potential, entry DFMH-30 for GFY and DMY registered its superiority. For quality parameters, entry DFMH-30 for CPY and AFB-9 for CPC proved superiority.

In **AVT-1 in forage Pearl Millet, t**hree entries along with three national checks were evaluated at six locations in north east zone. AFB-8 in north east zone exhibited superiority for GFY and DMY. For fodder production potential, entry AFB-8 maintained superiority both for green forage and dry matter production potential. In quality parameters, entry APFB-09-1 ranked first for CPY as well as Crude protein content.

COWPEA

In **IVT in Forage Cowpea,** Five entries along with two national checks and three zonal checks for respective zones were evaluated at 23 locations across the five zones. For GFY, entries MFC-09-9 in Hill zone; TNFC-0926 and UPC-1301 in North East zone and TNFC-0926 in South zone exhibited superiority. For DMY, entry MFC-09-9 in Hill zone; entries TNFC-0926 and UPC-1301 in North East zone and entries TNFC-0926 and MFC-09-9 in South zone exhibited their superiority with respect to best check. At national level, entry UPC-1301 proved superiority over best check UPC-5286. For fodder production potential, entry TNFC-0926 for green forage as well as for dry matter yield registered superiority. For quality parameters, UPC-1301 for CPY and HFC-11-3 for CPC was adjudged best performer.

In **AVT-1 in Forage Cowpea,** two entries along with two national checks and two zonal checks were evaluated at 12 locations across North East and south zone. At national level, check Bundel Lobia-1 maintained superiority for GFY. For DMY, entry TNFC-0924 was superior in North East and South zone as well as at national level. For fodder production potential, again TNFC-0924 ranked first both for green forage as well as dry matter production potential. For quality parameters, TNFC-0924 was best performer both for CPY as well as CPC.

RICE BEAN

In **IVT in forage rice bean**, four entries along with three national checks were evaluated at nine locations. For GFY, national check Bidhan-2 maintained its superiority. For dry matter yield, entry BFRB-17 established superiority. For fodder production potential, check variety RBL-6 ranked first both for green forage and dry matter production potential. For quality parameters, entry JRBJ-06-3 for CPY and check RBL-6 for Crude protein % registered superiority.

PERENNIAL FORAGES

Clitoria ternatea

In *Clitoria ternatea*, a varietal evaluation trial comprising seven entries was established initially in Kharif-2013 at eight locations. This is the first year of evaluation. Decoding of entries will be done after completion of the trial. For green forage yield entries VTCT-7, VTCT-3 and VTCT-1 were superior. For dry matter yield, entries VTCT-7, VTCT-1, VTCT-3, and VTCT-4 registered superiority. For quality parameters, entry VTCT-1 for CPY and entry VTCT-2 for CPC registered superiority.

Sewan grass (*Lasiurus sindicus*)

A varietal trial in Sewan comprising seven entries was established in Kharif-2010 at five locations of North West zone. This is being the 4th and final year of evaluation hence all the entries are decoded. Entries RLSB-11-50 and RLSB-7-50 registered superiority both for GFY and DMY. For fodder production potential, entry RLSB-11-50 ranked first both for green forage as well as dry matter production potential. For plant height and leafiness, entry CAZRI-30-5 ranked first. After compiling the data over the years, results revealed that for the character green forage yield and dry matter yield, entries RLSB-11-50 and RLSB-7-50 were superior.

Cenchrus setigerus

A varietal evaluation trial comprising seven entries and one check variety namely CAZRI-76 was established in Kharif 2010 at 12 locations. This being the 4th and final year of evaluation hence all the entries are decoded. For GFY, entries RCSB-02-08, CAZRI-550 and CAZRI-175 in North West zone exhibited their superiority. At national level, Check CAZRI-76 maintained superiority. Similarly for DMY, only one entry RCSB-02-08 proved its superiority in North West zone whereas in other zones as well as at national level national check maintained superiority. For quality parameters, national check CAZRI-76 adjudged best performer both for CPY as well as Crude Protein %. After compiling the data over the years, results clearly revealed that check variety CAZRI-76 maintained superiority both for green forage yield and dry matter yield.

This year is considered as establishment year for the following perennial crops and data will be reported from 2014 onwards.

Bajra Napier Hybrid

A varietal trial in Bajra Napier Hybrid comprising eight entries and three checks was established in Kharif-2013 at 18 locations in five zones of the country. Crop being perennial in nature, entries are in coded names.

Sehima

A varietal evaluation trial in *Sehima* comprising six entries and one check was established in Kharif-2013 at 15 locations in four zones of the country. Crop being perennial in nature, entries are in coded names.

Dichanthium

A varietal trial in *Dichanthium* comprising seven entries and one check was established in Kharif-2013 at 15 locations in four zones of the country. Crop being perennial in nature, entries are in coded names.

C. ciliaris

A varietal trial in *Cenchrus ciliaris* comprising seven entries and two checks was established in Kharif-2013 at 11 locations in three zones of the country. Crop being perennial in nature, entries are in coded names.

B. FORAGE CROP PRODUCTION

The programme on forage crop production was undertaken at 19 sites in five agro-climatic zones of the country. In total 20 experiments were conducted, out of which 9 in network (8 coordinated and 1 AVT based) and 11 in location specific mode were undertaken with the aim to generate region specific forage production technologies for different growing conditions.

Research aspect consisted of: resource conservation through forages; production and quality of BN hybrid under different growing environment and N levels; dual purpose pearlmillet under different cutting management practices and nitrogen levels; effect of nutrient management on productivity of perennial grasses under lowland condition; effect of stubble management and INM on forage productivity in rice-oat cropping system; study on different models for year round green fodder production under irrigated condition; evaluation of fodder crops under different rice fallow system; evaluation of different varieties of grass pea as forage crop under different sowing methods in rice based cropping system; location specific research on effect of soil amendments on productivity of rice-berseem and changes in soil properties of sodic soils; effect of levels of nitrogen on productivity of perennial grasses with and without tree shade; effect of time of sowing and seed rate on performance of fodder maize under rainfed condition; performance of fodder rice bean as influenced by dates of sowing and spacing ; enhancing the production potential of various forage crops in coconut gardens through nutrient management; cropping system studies in fodder maize with legume intercropping; effect of varying seed rate of forage legumes on productivity of fodder maize; performance of Bajra Napier hybrid grass as influenced by micronutrients under irrigated conditions ; residual effect of P applied to wheat on succeeding summer fodders in sorghum-wheat-summer fodder cropping system; weed management in multicut sorghum; effect of

herbicides on the weed control in Bajra-Napier hybrid and testing of new cowpea genotypes under different management for varietal development.

The summary of *Kharif*-2013 results is presented briefly as under:

AST-2: Effect of growing environment and nitrogen levels on production and quality of BN hybrid

(**Location:** Palampur, Ludhiana, Anand, Rahuri and Hyderabad)

On mean basis, growing of bajra Napier hybrid under unshaded environment recorded higher GFY (692.6 q/ha), DMY (138.2 q/ha), and CPY (14.9 q/ha) over shaded environment (539.9, 96.4 and 11.7q/ha, respectively). The magnitude of increase for GFY, DMY and CPY was 28.28, 43.36 and 27.35%. The green fodder, DMY, CPY and crude protein content of BN hybrid increased consistently with increasing levels of nitrogen up to 125% of recommended N. Growing of BN hybrid under unshaded environment fetched higher net return and benefit cost ratio at Palampur, Hyderabad and Ludhiana over shaded environment. Net monetary return and B: C ratio increased consistently with increasing levels of nitrogen up to 100 % of recommended N on mean basis. On mean basis, higher values of NDF (%), ADF (%) and oxalic acid (%) were recorded under unshaded condition over shaded condition. Growing of BN hybrid without nitrogen (control) recorded highest values of NDF (72.2%) and ADF (49.9%) over its higher levels of N on mean basis.

AST-3: Performance of dual purpose pearlmillet as influenced by different cutting management practices and nitrogen levels

(**Location:** Anand, Urulikanchan, Bikaner, Mandya, Hyderabad, Dharwad and Jhansi)

On location mean basis, planting of BAIF Bajra-1 recorded highest GFY (299.3 q/ha), stover yield (110.4 q/ha) and CPY (6.9 q/ha) and lowest with AVKB-19. Highest DMY (50.3 q/ha) was recorded by GFB-1 on mean basis. On mean basis cutting of pearl millet at 50 days after sowing and 2nd cut at 40 days after 1st cut and left for grain recorded higher GFY (434.5 q/ha), DMY (73.5 q/ha) and CPY (7.69 q/ha mean of Dharwad, Bikaner and Anand) as compared to first cut at 50 DAS and left for grain. Application of 150% recommended dose of nitrogen recorded higher GFY (306.9 q/ha), DMY (51.3 q/ha) and CPY (6.9 q/ha mean of Dharwad, Bikaner and Anand) over 100% of RDN. The magnitude of increase for GFY, DMY and CPY was 14.2, 17.9 and 17.5 percent more over 100% RDN. On mean basis GFB-1 recorded highest grain yield (9.6 q/ha), whereas highest stover yield (110.4 q/ha) was recorded with BAIF Bajra-1. On mean basis no cutting of pearl millet varieties recorded highest grain yield (14.4 q/ha) followed by first cut at 50 DAS and left for grain (8.7 q/ha) and lowest being with cutting at 50 DAS & 2nd cut at 40 days after 1st cut and left for grain (3.1q/ha). On mean as well as location basis, application of 150% of RDN to pearl millet varieties recorded highest grain and stover yields over 100 % RDN. The sowing of BAIF Bajra-1 fetched highest net monetary return (Rs.25135/ha) and benefit cost ratio (2.15) on mean basis. On mean basis cutting of dual purpose pearl millet varieties at 50 DAS and left for grain fetched highest net monetary return (Rs 24081/ha) over rest of the cutting management practices. On mean basis as well as location wise, application of 150% of recommended dose of nitrogen realized highest net monetary return (Rs. 24153/ha) and benefit cost ratio (2.10) over its lower level of 100% of RDN.

AST -4: Effect of levels of nitrogen on productivity of perennial grass with and without tree shade

(**Location:** Jorhat, Bhubaneswar and Jabalpur)

At Jorhat, significantly higher green fodder and dry matter yield was observed with para grass over koronga dol and local dol grasses. The application of 100% NPK (inorganic fertilizer), 50% NPK (inorganic fert) + FYM 5t/ha and FYM 10t/ha increased the green fodder yield by 51.6, 70.0 and 71.4%, respectively, over farmerôs practice. The para grass with 50% NPK (inorganic fert) +FYM 5t/ha gave significantly higher GFY (835 q/ha) over all other combinations. At Bhubaneswar, para grass produced highest GFY (438.8 q/ha) followed by Humidicola grass. Similar trend has been realized in DMY. Among the nutrient management practices, 100% NPK (inorganic fertilizer) resulted in significantly higher green fodder production as compared to other treatments. The application of 100% NPK (inorganic fertilizer), 50% NPK (inorganic fert) + FYM 5t/ha and FYM 10t/ha increased GFY by 85.5, 66.3 and 25.9%, respectively, over farmerôs practice. The planting

of para grass with 100% NPK (inorganic fertilizer) resulted in significantly higher GFY as compared to all other combinations except para grass with 50% NPK through inorganic fertilizer + FYM @ 5 t/ha. At Jabalpur, planting of para grass with 100% NPK (inorganic fertilizer) and 50% NPK through inorganic fertilizer + FYM @ 5 t/ha gave higher GFY as compared to other combinations. But, significantly highest DMY (56.2 q/ha) was recorded in para grass with 100% NPK (inorganic fertilizer).

AST -12: Effect of levels of nitrogen on productivity of perennial grass with and without tree shade (**Location:** Jorhat)

Perennial grasses yielded 79% higher green and 80% higher dry matter under open condition than under shade. It was revealed that with increasing levels of nitrogen, GFY increased significantly under both the conditions. CPY found to be highest in the treatment receiving 25 per cent > RDNF which was found to be significantly superior over RDNF, 25 per cent < RDNF. The highest total green forage yield of 1235.6 q/ha/year was obtained under open condition in Congosignal grass. The highest net monetary return was recorded under open condition (Rs 116220/ha). On the other hand Congosignal grass recorded higher net monetary return than Setaria. There was increase in net monetary return along with increase in N levels and the highest being observed in 25%> RDNF.

AST–13: Effect of time of sowing and seed rate on performance of fodder maize (*Zea mays*) under rainfed condition (**Location:** Imphal)

Among different date of sowing, maize sown on 26th May produced significantly highest green fodder yield (505.2q/ha), DMY (161.2q/ha), CPY (15.4 q/ha), plant height (263.9 cm), NMR (Rs. 59607/ha) and benefit cost ratio (3.69) over rest of the dates of sowing. With respect to seed rate, maize sown at seed rate of 80 kg/ha recorded maximum green fodder yield (417.5 q/ha) and net monetary returns (Rs.45780/ha). With respect to interaction effect among different date of sowing and seed rate, maize sown on 26th May with a seed rate of 60kg/ha produced highest green fodder yield (546.6 q/ha) and net returns (Rs 65812/ha) over rest of the combinations.

AST – 14: Performance of fodder rice bean as influenced by dates of sowing and spacing (**Location:** Imphal)

Sowing of maize on 26th May produced significantly highest GFY (312.7 q/ha), DMY (63.8 q/ha), CYP (7.2 q/ha), net monetary returns (Rs. 31519/ha) and benefit cost ratio (2.05) as compared to maize sowed on 4th June and 14th June. With respect to spacing, planting of maize at the spacing of 25 cm being at par with 35 cm spacing recorded significantly higher GFY (233.1 q/ha), DMY (50.0 q/ha), NMR (Rs 19567/ha) and benefit cost ratio (1.27) over spacing of 45 cm. Sowing of rice bean on 26th May with a spacing of 25 cm produced highest GFY (321.9 q/ha) and net monetary return (Rs. 32902/ha) over rest of the combinations.

AST-15: Enhancing the production potential of various forage crops in coconut gardens through nutrient management (**Location:** Mandya**)**

Planting of BN hybrid recorded significantly highest GFY (384.2q/ha), DMY (86.5q/ha), net monetary returns (Rs. 27271/ha) & benefit cost ratio (3.41) over guinea & signal grass. The application of 150% RDNF to different crop(s) recorded highest GFY (326.7q/ha), DMY (84.8q/ha), net monetary returns (Rs.23438/ha) & benefit cost ratio (2.08). The maximum light interception in the bottom of the canopy was observed in BN hybrid with application of 150% RDNF (25.95%), whereas, maximum light Interception at the middle of the canopy was recorded in signal grass with 150% RDNF (16.78%).

AST-16: Cropping system studies in fodder maize with legume intercropping (**Location:** Srinagar**)**

GFY (480.2 q/ha) and DMY (144.3 q/ha) of sole maize was significantly higher than both sole legumes as well as different intercropping ratios. However, it (sole maize) remained at par with mixed intercropping of soybean in terms of GFY. Highest maize fodder equivalent yield (495 q/ha) was recorded in maize + soybean mixed cropping system over rest of the treatments.

AST-17: Effect of varying seed rate of forage legumes on productivity of fodder maize
(Location: Srinagar)

Sole maize recorded significantly high GFY (490.3 q/ha) and DMY (137.2 q/ha) over rest of the intercropping systems including both sole cowpea and sole soybean. Maize + cowpea @ 60 kg/ha seed rate showed significant increase of both GFY (340.3 q/ha) and DMY (64.6 q/ha) over maize + cowpea @ 20 kg/ha seed rate but remained at par with maize + cowpea @ 40 kg/ha seed rate. Planting of maize + soybean @ 60 or 80 kg/ha recorded significantly higher GFY and DMY over maize + soybean @ 40 kg/ha seed rate

AST-20 (NT): Weed management in multicut sorghum
(Location: Ludhiana)

Among the herbicide treatments, the highest weed control efficiency was noticed in propaquizalofop 0.0625 and 0.075 kg/ha closely followed by atrazine + pendimethalin combinations. The highest green fodder yield (905.5 q/ha) and dry matter yield (172.8 q/ha) was obtained with hand weeding which was at par with atrazine + pendimethalin combinations.

AST-21 (NT): Effect of herbicides on the weed control in Bajra-Napier hybrid
(**Location:** Ludhiana)
The weed control efficiency with atrazine alone, pendimethalin alone and atrazine + pendimethalin combinations ranged between 57.0 to 62.8, 73.0 to 76.7, 86.4 to 91.6 %, respectively as compared to 82.5 % WCE in hand weeding. The highest green fodder yield (1288.9 q/ha) and dry matter yield (223.6 q/ha) was obtained with hand weeding which was at par with atrazine + pendimethalin combinations. Among herbicides, the highest fodder (1270.7 q/ha green fodder and 220.5 q/ha dry matter) yield was observed with atrazine 0.5 kg + pendimethalin 0.560 kg a.i./ha closely followed by atrazine 0.75 + pendimethalin 0.560 kg a.i./ha. The highest B:C ratio was obtained with atrazine 1.0 + pendimethalin 0.75 kg a.i./ha closely followed by atrazine 0.75 + pendimethalin 0.560 and atrazine 0.5 kg + pendimethalin 0.560 kg a.i./ha.

AST-22: Effect of phosphorus levels on forage yield of promising entries of cowpea (AVT-2)
(Location: Mandya, Vellayani, Coimbatore, Hyderabad and Dharwad)

On over all mean basis, testing entry MFC 09-1 recorded highest green fodder yield, dry fodder yield and crude protein yields over rest of the entries. The entry MFC 09-1 resulted in 18.88, 8.52, 10.47 and 13.38 per cent increase in green fodder yield over RR-3, UPC 9202 (ZC), UPC 5286 (NC) and Bundel Lobia-1 (NC), respectively. The influence of phosphorus on these parameters was linear up to the highest tested rate of P application (90 kg ha^{-1}) and registered percent increase of 20.71 and 8.63 for GFY and 23.05 and 10.81 for DFY over 30 and 60 kg P_2O_5kg/ha, respectively.

C. FORAGE CROP PROTECTION

Forage crop protection trial in major *Kharif* forages included pest occurrence, evaluation of breeding material to pest and diseases resistance and pest management. These were conducted at Bhubaneswar, Hisar, Hyderabad, Jhansi, Ludhiana, Palampur and Rahuri centres.

Pest occurrence: Monitoring of diseases and insect pest in Sorghum, Pearl Millet, Maize and Cowpea revealed that at Jhansi zonate leaf spot (*Gleocercospora sorghi*), anthracnose (*Colletotrichum graminicola*) and gray leaf spot (*Cercospora sorghi*) sooty stripe (*Ramulispora sorghi*) and leaf blight (*Helminthosporium turcicum*) were predominating diseases in var. MP Chari. Percent disease incidence ranged from 20-70%

Their spread and development was favoured by mean temperature around 30°C and humidity 80%. At Ludhiana, zonate and grey leaf spot appeared on sorghum var SL-44. These diseases progressed rapidly under RH 75-80% and temperature 30°C during September. At Palampur leaf blight incidences by *Helminthosporium turcicum* was initiated in the mid of July (5%) and progressed (20%) upto last week of August. At Bhubaneswar, leaf spot and leaf blight incidences occurred. Among the insect pest, shoot fly (*Atherigona aproximata*), leaf defoliators and aphid (*Rhopalosiphum maidis*) were recorded at Bhubaneswar, Jhansi and Rahuri. The natural enemy of aphid ladybird beetle and *Chrysopa cornea* were also recorded at Rahuri.

In Cowpea, root rot caused by *Rhizoctonia solani, R. bataticola and Sclerotium rolfsii* was recorded in severe form at Jhansi centre due to continuous heavy rain during the crop season. At Bhubaneswar, mosaic appeared in third week of August and continued to increase upto 1.8 rating in 1-5 scale. At Palampur, wilt and root rot were severe (28-42%) during the month of July. Cowpea aphid (20-157/leaf) and flea beetle (12.6-114.6 holes/plant) were recorded during the crop season. Maximum aphid infestation (25%) was recorded at Hyderabad in the last week of September. At Rahuri, low to moderate infestation of aphid and jassids was recorded (1.33-27.66/plant) in the month of August to September.

In Maize, leaf blight incidence started from first week of August and progressed up to first week of September (2.4) on 1-5 scale at Bhubneahwar. At Ludhiana, severity of maydis leaf blight was noticed in the first week of August 2013 on var J 1006 and progressed rapidly up to mid September 2013 as max RH above 70-75% and mean temperature was 28-31°C. At Palampur, leaf blight (*H. maydis* and *H tercecium*) appeared in the second week of July and severity continued to increase (25%) up to the 3rd week of August. Banded leaf and sheath blight (*Rhizoctonia sp*) were also observed in mild form. At Jhansi, incidences of maydis leaf blight were recorded during the crop season. In Maize and Pearl Millet, shoot fly and aphid among the insect and leaf blight diseases were predominating at Bhubaneswar, Jhansi, Ludhiana, Palampur and Rahuri.

Evaluation of breeding material: In trial on evaluation of varietal resistance, cowpea entries UPC-9202, TNFC-0926, UPC-622, HBC-11-3 AND UPC-1301 showed tolerance to pest and diseases at different locations. The flea beetle population was least in AVT entry UPC-9202 at Hyderabad centre. All the AVT entries of cowpea were resistant for YMV at all the centers expect Hyderabad.

In Pearl Millet, all the IVT and AVT entries were found resistant to leaf spot and sheath blight at Bhubaneswar and Jhansi however at Ludhiana RBB-4, AFB-9 and DFMH-30 showed moderately resistant reactions against leaf spot. All the entries showed resistance to downy mildew at Ludhiana. In IVT maize, all the entries were found susceptible to moderately susceptible for maydis leaf spot at Ludhiana, however at Rahuri, all the entries were resistance to moderately resistance. All the entries were found resistant to moderately resistant for leaf blight at Jhansi, Palampur and Bhubaneswar. In hybrid trials, all the entries were found moderately resistant at Palampur and Bhubaneswar but susceptible at Ludhiana for maydis leaf spot

In IVT all Ricebean entries were found resistant to leaf spot and root rot at Bhubaneswar. All the entries were found disease free at Jhansi.

Diseases and Pest Management:

- At Bhubaneswar, for management of root rot of cowpea, seed treatment with *Trichoderma viride* @ 5 g/kg seed + FYM @ 2 t/ha was statistically significant in respect to Green Forage Yield (141.0 q/h), Dry Matter Yield (29.0 q/h) and Net Monetary Return (6915.4 Rs/ha/yr) as compared to untreated control while it is considered to be statistically significant in respect to % germination *in vitro* as well as *in vivo.*
- In trial on Management of foliar diseases of forage sorghum, lowest disease incidence as well as highest forage yield were recorded in seed treatment with carbendazim (2 g/kg) seed + Two foliar sprays of propiconazole (0.1%) and seed treatment with *T. viride* (5g/kg) seed + Two foliar sprays of propiconazole (0.1 %) at Bhubaneswar, Ludhiana, Palampur and Jhansi. Both the treatments were statistically at par in all the centres.
- In trial on Integrated management of root rot and foliar diseases of forage cowpea early sowing recorded minimum root rot incidence and highest yield followed by normal and late sown at all the centres However, all the treatment in three sowing dates was found effective against the root rot and foliar disease. Among different treatments T2 (Seed treatment with *Trichoderma viride* + *Paecilomyces lilacinus* @ 5 g/kg seed each followed by foliar sprays of propiconazole @ 1ml/l at 15 days interval) was found to be the best treatment as it reduced the disease to maximum extent and in turn provided maximum GFY at all the centres.

D. BREEDER SEED PRODUCTION

In Kharif-2013, the indent for Breeder Seed Production was received from DAC, GOI for 29 varieties in six forage crops *viz*., Maize, Pearl millet, Cowpea, Sorghum, Guar and Rice bean. The total indents were 152.22 q and was allocated to 13 SAUs/ICAR/NGO institutes. Among quantity allocated for different forage crops, the maximum was for Maize (89.00 q) followed by Sorghum (33.35 q), Cowpea (20.05 q), Guar (4.10), Rice bean (3.00 q) and minimum was for Pearl millet (2.72 q).

In Maize, Pearl millet and Rice bean (expected yield), the overall breeder seed production was higher than the allocated quantity whereas in Cowpea, Sorghum and Guar, the breeder seed production was less than the allocated quantity. In Maize, the production was 137.5 q (48.5 q surplus), in Pearl millet production was 6.30 q (3.60 q surplus) and in Rice bean the production was 4.20 q (1.20 q surplus). However in cowpea, the production was 10.00 q (10.05 q deficit) against the allocation of 20.05 q. Similarly in Sorghum, there was 13.9 q deficits in production with respect to 33.35 q allocation and in Guar against the allocation of 4.10 q the actual production was 0.80 q (3.30 deficit). The overall breeder seed production was 178.26 q against the allocation of 152.22 q, which was 26.04 surplus or 17.11 per cent higher than the quantity allocated.

ALL INDIA CCOORDINATED RESEARCH PROJECT ON FORAGE CROPS
ZONE, COORDINATED CENTERS AND TESTING LOCATIONS

Zone	Coordinated Centers				Testing Location		
	Sl. No.	Location	Establishment Year	State	Sl. No.	Location	State
I. Hill States = 03 Locations = 2+2 = 4	1.	Palampur, CSKHPKV	1970	Himachal Pradesh	1.	Almora, VPKAS*	Uttarakhand
	2.	Srinagar, SKUAT	2010	Jammu & Kashmir			
II. North West States = 05 Locations = 4+5 = 9	3.	Ludhiana, PAU	1989	Punjab	2.	Meerut, SVBPUA&T	Uttar Pradesh
	4.	Hisar, CCS HAU	1970	Haryana	3.	Avikanagar, IGFRI-RRS*	Rajasthan
	5.	Pantnagar, GBPUAT	1995	Uttarakhand	4.	Jodhpur, CAZRI-RRS*	Rajasthan
	6.	Bikaner, SKRAU	1995	Rajasthan	5.	Jalore, RAU-RRS	Rajasthan
					6.	Udaipur MPUAT	Rajasthan
					7.	Pali-Marwar CAZRI-RRS*	Rajasthan
					8.	Jaisalmer, CAZRI-RRS*	Rajasthan
					9.	Fatehpur Shekhawati, SKRAU	Rajasthan
					10.	Bawal, HAU	Haryana
III. North East States = 8 Locations = 6+2= 8	7.	Faizabad, NDUAT	1982	Uttar Pradesh	11.	Umiam (Barapani), ICAR Res. Complex for NEH Region*	Meghalaya
	8.	Ranchi, BAU	1970	Jharkhand	12.	Pusa, RAU	Bihar
	9.	Kalyani, BCKV	1972	West Bengal			
	10.	Bhubaneswar,OUAT	1987	Orissa			
	11.	Jorhat, AAU	1970	Assam			
	12.	Imphal, CAU	2010	Manipur			

Zone	Coordinated Centers				Testing Location (Coordinating Center)		
	Sl. No.	Location	Establishment Year	State	Sl. No	Location	State
IV. Central States = 5 Locations = 5+5 =10	13.	Anand, AAU	1970	Gujarat	13.	Kanpur, CSAU&T	Uttar Pradesh
	14.	Jabalpur, JNKVV	1970	Madhya Pradesh	14.	Jhansi, IGFRI*	Uttar Pradesh
	15.	Rahuri, MPKV	1971	Maharashtra	15.	Dhari & Jamnagar, GAU	Gujarat
	16.	Urulikanchan, BAIF	1982	Maharashtra	16.	Akola, PDKVV	Maharashtra
	17.	Raipur, IGKV	2010	Chhattisgarh	17.	Dapoli & Palghar, KKV	Maharashtra
V. South States =5 Locations = 4+3 = 7	18.	Mandya, UAS (B)	1986	Karnataka	18.	Dharwad, IGFRI-RRS*	Karnataka
	19.	Coimbatore, TNAU	1976	Tamil Nadu	19.	Pondicherry, PJLNCA & RI, Karaikal	Pondicherry
	20.	Vellayani, KAU	1971	Kerala			
	21.	Hyderabad, ANGRAU	1970	Andhra Pradesh			

Summary: Zone = 5, States = 23, Coordinating Centres = 21, Testing Locations = 19

*ICAR Institute

AICRP ON FORAGE CROPS: ENTRIES CODE FOR KHARIF 2013

S. N.	Contributor	Designation	Code
1. IVTM: Initial varietal trial in Forage Maize (NEW)			
1	Palampur	PFM-7	IVTM-7
2	Anand	AFM-1	IVTM-8
3	Anand	AFM-2	IVTM-6
4	Anand	AFM-3	IVTM-5
5	IGFRI ,Jhansi	JHM-13-1	IVTM-1
6	BAIF, Urulikanchan	BAIF Maize-3	IVTM-2
7	NC	African Tall	IVTM-4
8	NC	J-1006	IVTM-3
2. AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize			
1	Advanta	IHTFM (PAC -745)	AHM-6
2	Hyderabad	DHM-117	AHM-5
3	Ludhiana	PMH-1	AHM-1
4	Ludhiana	PMH-3	AHM-4
5	NC	African Tall	AHM-3
6	NC	J-1006	AHM-2
3. IVTPM: Initial varietal trial in Forage Pearl millet			
1	Hyderabad	APFB-09-3 (x)	IVTPM-5
2	Faizabad	NDFB-939	IVTPM-6
3	Anand	AFB-9	IVTPM-7
4	Bikaner	RBB-4	IVTPM-4
5	deVGen	DFMH-30	IVTPM-9
6	Hisar	HFP-12-3	IVTPM-2
7	NC	Raj Bajra Chari-2	IVTPM-8
8	NC	Giant Bajra	IVTPM-1
9	NC	AVKB-19	IVTPM-3
4. AVTPM-1: First Advanced Varietal Trial in Forage Pearl millet			
1	Hyderabad	APFB-09-1	APM-6
2	Faizabad	NDFB-936	APM-4
3	Anand	AFB-8	APM-1
4	NC	Raj Bajra Chari-2	APM-5
5	NC	Giant Bajra	APM-3
6	NC	AVKB-19	APM-2
5. IVTC: Initial Varietal Trial in Forage Cowpea (New)			
1	Coimbatore	TNFC-0926	IFC-4
2	Srinagar	SKFC-1	IFC-6
3	Mandya	MFC-09-9	IFC-5
4	Hisar	HFC-11-3	IFC-9
5	Pantnagar	UPC-1301	IFC-10
6	NC	Bundel Lobia-1 (NC)	IFC-2
7	NC	UPC-5286 (NC)	IFC-7
8	ZC (NWZ)	Bundel Lobia-2 (NWZ)	IFC-1
9	ZC (NEZ/HZ)	UPC-622 (NEZ/HZ)	IFC-8
10	ZC (CZ/SZ)	UPC-9202 (CZ/SZ)	IFC-3

S. No.	Contributor	Designation	Code
6. AVTC-1: First Advanced varietal trial in Forage Cowpea			
1	Coimbatore	TNFC-0924	AFC-5
2	Mandya	MFC-09-5	AFC-1
3	NC	Bundel Lobia-1	AFC-3
4	NC	UPC-5286	AFC-4
5	ZC (NEZ)	UPC-622 (NEZ)	AFC-2
6	ZC (SZ)	UPC-9202 (SZ)	AFC-6
7. IVT (Rice bean): Initial Varietal Trial in Rice bean			
1	Jorhat	JRB-18	IRB-6
2	Jorhat	JRB-19	IRB-5
3	Jabalpur	JRBJ-06-3	IRB-4
4	Bhubaneswar	BFRB-17	IRB-2
5	NC	K-1 (Bidhan-1)	IRB-3
6	NC	Bidhan-2	IRB-7
7	NC	RBL-6	IRB-1
13. VT Sewan (*Lasiurus sindicus*)-2010			
1	Bikaner	RLSB-4-26	IVTS-10-1
2	Bikaner	RLSB-11-50	IVTS-10-2
3	Bikaner	RLSB-11-49	IVTS-10-3
4	Jodhpur	CAZRI/BKN/08-10	IVTS-10-4
5	Jodhpur	CAZRI-30-5	IVTS-10-5
6	Bikaner	RLSB-7-45	IVTS-10-6
7	Bikaner	RLSB-7-50	IVTS-10-7
14. VT *Cenchrus setigerus*-2010			
1	Bikaner	RCSB-02-46	VTCS-10-1
2	Bikaner	RCSB-02-52	VTCS-10-2
3	Bikaner	RCSB-02-08	VTCS-10-3
4	NC	CAZRI-76	VTCS-10-4
5	Jodhpur	CAZRI-175	VTCS-10-5
6	Jodhpur	CAZRI-296	VTCS-10-6
7	Jodhpur	CAZRI-550	VTCS-10-7

DECODES OF ENTRIES OF AVT AGRONOMICAL TRIAL KHARIF-2013

S. No.	Name of Entry	Code
1	UPC 5286 (NC)	AVTC-2-A
2	Bundel Lobia-1 (NC)	AVTC-2-B
3	UPC 9202 (SZ)	AVTC-2-D
4	MFC 09-1	AVTC-2-E
5	RR-3	AVTC-2-C

CHAPTER-1

FORAGE CROP IMPROVEMENT

1. IVTM: Initial Varietal Trial in Forage Maize

Six entries along with two national checks *viz*; African Tall and J-1006 were evaluated at 22 locations distributed in the five zones. For green forage yield (q/ha), entries AFM-2 (5.5%) and JHM-13-1 (2.9%) in Hill zone, entries AFM-3 (13.2%), AFM-1 (11.1%), PFM-7 (9.9%) and AFM-2 (8.1%) in North West zone, entry AFM-3 (6.1%) in North East zone exhibited superiority over best national check. However in other zones, African Tall maintained superiority whereas at national level entry AFM-3 (0.8%) ranked first for this character.

For dry matter yield (q/ha), entries AFM-2 (9.2%) and JHM-13-1 (1.0%) in Hill zone; entries AFM-3 (43.9%), PFM-7 (29.8%), AFM-2 (24.8%) and AFM-1 (19.6%) in North West zone; entry AFM-3 (9.6%) in North East Zone; entries AFM-3 (18.1%), AFM-1 (1.67%), JHM-13-1 (1.4%) and AFM-2 (0.77%) in Central zone exhibited superiority over best national check. While, at national level, entry AFM-3 (12.4%) ranked first for this character. For fodder production potential (q/ha/day), entry AFM-3 ranked first both for green forage and dry matter production potential. For plant height, national check African Tall (195.6 cm) ranked first whereas for leaf stem ratio, entry AFM-3 and African Tall (0.58) was the best.

In Quality parameters, entry AFM-3 ranked first for crude protein yield (q/ha) as well as for crude protein content. For other quality parameters, entries African Tall and AFM-3 for ADF (%), African Tall for NDF (%) and AFM-1 for IVDMD (%) were best performers.

(Table Reference: 1.1 to 1.9)

2. AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize

Four entries along with two national checks *viz;* African Tall and J-1006 were evaluated in advanced hybrid varietal trial at ten locations. For the character green forage yield (q/ha), entries PMH-3 (11.8%) and DHM-117 (5.3%) in Hill zone; entry IHTFM (29.6%) in North West zone; entries IHTFM (11.9%), PMH-1 (9.3%), DHM-117 (5.3%) and PMH-3 (5.0%) in North East zone exhibited their superiority over best national check whereas at national level entry IHTFM (15.4%) ranked first for this character.

Similarly for dry matter yield (q/ha), entries PMH-3 (11.3%) and DHM-117 (2.7%) in Hill zone; entries IHTFM (55.5%) and PMH-1 (2.2%) in North West zone; entries IHTFM (20.8%), PMH-1 (15.4%), DHM-117 (11.6%) and PMH-3 (3.3%) in North East zone exhibited superiority over best national check. While, at national level, entry IHTFM (22.7%) ranked first. For fodder production potential (q/ha/day), entry IHTFM maintained its superiority both for green forage and dry matter production potential. For plant height and leaf stem ratio, national check African Tall established superiority.

In quality parameters like crude protein yield (q/ha) and crude protein content (%), entries IHTFM and PMH-3, respectively established superiority. For other quality parameters, African Tall for ADF (%) and IVDMD (%) and PMH-1 for NDF (%) maintained superiority.

(Table Reference: 2.1 to 2.6)

Table 1.1 IVTM: Initial Varietal Trial in Forage Maize: Green Forage Yield (q/ha)

Entries	Hill Zone						North West Zone								North East Zone						
	Palam.	Srina.	Almora	Avera.	Rank	Super%	Ludhi.	Hisar	Udaip.	Jalore	Pantn.	Avera.	Rank	Super%	Faiza.	Bhuban.	Ranchi	Jorhat	Avera.	Rank	Super%
JHM-13-1	471.4	323.2	390.8	395.1	2	2.9	294.0	171.3	291.7	380.0	200.0	267.4	7		31.9	510.3	620.0	227.8	347.5	3	
BAIF Maize-3	353.9	315.4	304.7	324.7	7		226.9	175.9	289.4	368.7	184.0	249.0	8		35.9	500.3	453.6	293.4	320.8	6	
AFM-3	467.1	316.5	269.9	351.2	4		627.3	189.8	294.0	373.3	150.0	326.9	1	13.2	110.3	631.2	555.6	227.8	381.2	1	6.1
AFM-2	496.2	333.3	384.8	404.8	1	5.5	597.2	203.7	314.8	328.3	117.0	312.2	4	8.1	80.1	518.7	518.6	260.1	344.4	4	
PFM-7	443.8	299.0	248.9	330.6	6		439.8	284.3	305.6	326.7	230.0	317.3	3	9.9	97.2	471.1	416.7	244.4	307.4	8	
AFM-1	470.3	303.7	232.9	335.6	5		567.1	254.6	268.5	341.0	173.0	320.8	2	11.1	120.1	474.2	481.4	203.4	319.8	7	
J-1006 (NC)	339.6	302.8	325.0	322.5	8		409.7	129.6	291.7	361.7	207.3	280.0	6		107.8	519.4	536.9	272.5	359.2	2	
African Tall (NC)	507.9	341.5	301.9	383.8	3		463.0	135.0	266.2	416.3	163.0	288.7	5		107.0	513.1	398.1	301.4	329.9	5	
Mean	**443.8**	**316.9**	**307.3**	**356.0**			**453.1**	**193.0**	**290.2**	**362.0**	**178.0**	**295.3**			**86.3**	**517.3**	**497.6**	**253.9**	**338.8**		
CD at 5%	82.4	17.4	98.2				43.5	63.7	NS	34.3	42.8				17.3	61.7	2.8	6.6			
CV%	10.6	3.1	18.5				10.6	18.7	13.5	5.3	13.8				11.5	6.8	9.0	8.4			

Entries	Central Zone								South Zone						All India Average		
	Anand	Raip.	Jabal.	Rahuri	Urulik.	Jhansi	Avera.	Rank	Hydera.	Coimb.	Mandya	Karaik.	Avera.	Rank	Avera.	Rank	Super%
JHM-13-1	188.0	521.7	443.6	438.1	506.5	291.7	398.3	7	783.0	620.4	193.7	370.5	491.9	2	375.9	5	
BAIF Maize-3	212.0	588.2	402.0	414.5	567.8	245.4	405.0	6	653.3	481.5	198.0	403.9	434.2	5	348.6	8	
AFM-3	393.0	709.2	318.7	448.5	551.5	277.8	449.8	2	820.1	537.0	129.9	445.1	483.0	3	402.0	1	0.8
AFM-2	331.0	567.3	393.6	358.3	596.4	254.6	416.9	5	750.6	425.9	168.4	324.5	417.4	8	378.3	4	
PFM-7	253.0	533.9	283.2	408.3	637.3	263.9	396.6	8	546.7	523.1	265.4	362.4	424.4	7	358.4	7	
AFM-1	298.0	642.4	349.9	416.6	678.1	287.0	445.3	3	695.7	476.9	220.7	423.7	454.2	4	380.9	3	
J-1006 (NC)	238.0	647.8	393.6	420.1	600.5	263.9	427.3	4	593.1	495.4	206.2	437.2	433.0	6	368.2	6	
African Tall (NC)	224.0	722.5	266.6	472.1	833.3	282.4	466.8	1	722.8	625.0	208.2	501.5	514.4	1	398.8	2	
Mean	**267.1**	**616.6**	**356.4**	**422.1**	**621.4**	**270.8**	**425.7**		**695.7**	**523.1**	**198.8**	**408.6**	**456.6**		**376.4**		
CD at 5%	41.3	74.0	79.2	44.0	21.3	16.8			78.4	66.4	24.2	47.2					
CV%	8.8	6.8	12.7	6.0	15.6	9.6			6.7	7.3	7.0	6.6					

Table 1.2 IVTM: Initial Varietal Trial in Forage Maize: Dry Matter Yield (q/ha)

Entries	Hill Zone						North West Zone						North East Zone						
	Palam.	Srina.	Almora	Avera.	Rank	Super%	Ludhi.	Hisar	Pantn.	Avera.	Rank	Super%	Faiza.	Bhuba.	Ranchi	Jorhat	Avera.	Rank	Super%
JHM-13-1	91.6	80.9	81.0	84.5	2	1.0	72.4	33.6	46.0	50.7	6		6.9	116.7	140.6	39.8	76.0	4	
BAIF Maize-3	66.4	78.7	60.5	68.5	8		63.9	35.1	46.9	48.6	8		10.1	112.3	99.2	58.4	70.0	7	
AFM-3	93.0	78.6	72.2	81.3	4		146.9	39.0	38.6	74.8	1	43.9	35.9	136.8	124.4	45.1	85.6	1	9.6
AFM-2	98.4	84.2	91.4	91.3	1	9.2	128.1	40.4	26.3	64.9	3	24.8	22.9	120.6	116.9	51.4	77.9	3	
PFM-7	86.0	72.1	54.9	71.0	6		83.3	62.1	57.2	67.5	2	29.8	27.8	111.4	99.7	48.3	71.8	6	
AFM-1	89.8	75.4	53.4	72.9	5		95.8	47.5	43.3	62.2	4	19.6	36.4	112.1	107.8	41.3	74.4	5	
J-1006 (NC)	63.4	75.6	71.7	70.2	7		72.5	26.8	48.3	49.2	7		29.4	114.6	116.4	52.1	78.1	2	
African Tall (NC)	99.6	84.4	66.8	83.6	3		90.3	24.0	41.8	52.0	5		26.1	112.8	65.8	53.3	64.5	8	
Mean	**86.0**	**78.7**	**69.0**	**77.9**			**94.2**	**38.6**	**43.6**	**58.8**			**24.4**	**117.2**	**108.9**	**48.7**	**74.8**		
CD at 5%	19.5	0.7	17.3				17.5	12.2	11.3				6.2	16.2	31.1	3.9			
CV%	13.0	0.5	14.0				11.4	17.9	14.8				14.6	7.9	16.1	11.3			

Entries	Central Zone									South Zone						All India Average		
	Anand	Raipur	Jabal.	Rahuri	Jhansi	Urulik.*	Avera.	Rank	Super.%	Hyder.	Coimb.	Mandya	Karaik.	Avera.	Rank	Avera.	Rank	Super%
JHM-13-1	32.4	108.4	108.7	68.9	75.9	101.6	78.9	3	1.4	117.0	116.3	41.5	69.5	86.1	3	76.2	2	0.66
BAIF Maize-3	29.6	123.2	97.4	59.3	48.3	104.9	71.6	7		102.3	94.8	29.9	84.8	77.9	4	68.5	8	
AFM-3	80.5	150.1	74.7	69.5	84.6	107.6	91.9	1	18.1	134.3	88.3	24.9	99.2	86.7	2	85.1	1	12.4
AFM-2	55.0	118.6	94.5	57.3	66.6	104.1	78.4	4	0.77	98.1	83.6	21.7	67.1	67.6	8	76.0	3	0.4
PFM-7	41.3	111.2	64.3	67.6	48.0	121.8	66.5	8		78.7	104.3	40.8	71.4	73.8	6	70.0	7	
AFM-1	45.3	135.3	83.5	57.5	74.1	136.4	79.1	2	1.67	56.3	93.2	39.9	89.8	69.8	7	72.5	5	
J-1006 (NC)	35.7	136.5	94.7	67.0	55.1	120.1	77.8	5		85.1	87.4	32.0	95.5	75.0	5	71.6	6	
African Tall (NC)	43.2	153.1	58.9	77.4	52.3	186.1	77.0	6		108.8	119.6	40.6	119.6	97.2	1	75.7	4	
Mean	**45.4**	**129.5**	**84.6**	**65.6**	**63.1**	**122.8**	**77.6**			**97.6**	**98.4**	**33.9**	**87.1**	**79.3**		**74.4**		
CD at 5%	6.6	16.5	19.1	7.0	10.1	7.9				16.5	18.5	6.8	22.9					
CV%	8.3	7.2	13.0	6.1	5.8	20.0				9.7	10.7	11.4	15.0					

***not included in zonal and all india average due to cv>20**

Table 1.3 IVTM: Initial Varietal Trial in Forage Maize: Green Forage Yield (q/ha/day)

Entries	Palam.	Srina.	Ludhi.	Hisar	Pantn.	Faiza.	Bhuban.	Ranchi	Jorhat	Anand	Raipur	Jabal.	Rahuri	Urulika.	Hyder.	Coimb.	Mandya	Avera.	Rank
JHM-13-1	7.60	4.14	4.40	2.04	3.47	0.42	8.95	10.51	3.30	3.13	8.03	7.04	7.18	8.44	12.10	10.88	3.60	6.19	6
BAIF Maize-3	5.74	3.94	3.40	2.09	3.40	0.48	10.28	9.26	4.73	4.08	9.05	6.18	7.27	9.46	9.90	8.60	3.65	5.97	8
AFM-3	7.62	4.10	9.40	2.26	2.59	1.60	11.48	10.68	3.49	6.55	10.91	4.90	7.48	9.19	11.70	8.26	2.26	6.73	1
AFM-2	8.21	4.05	8.90	2.43	2.09	1.11	10.96	10.16	4.20	6.37	8.73	6.15	6.07	9.94	12.90	7.74	3.02	6.65	2
PFM-7	7.22	3.79	6.60	3.38	4.10	1.31	10.17	9.08	3.94	4.87	8.21	4.42	7.29	10.62	9.10	9.02	4.74	6.34	5
AFM-1	7.65	3.79	8.50	3.03	3.04	1.64	9.88	10.58	3.28	5.42	9.88	5.30	7.18	11.30	8.40	7.34	3.97	6.48	3
J-1006 (NC)	5.66	3.83	6.10	1.54	3.70	1.45	9.74	9.94	4.07	4.33	9.97	5.96	7.00	10.01	9.60	8.26	3.66	6.17	7
African Tall (NC)	8.15	4.27	6.90	1.61	2.63	1.57	8.80	6.22	4.41	3.45	11.12	4.03	6.94	13.89	11.30	10.08	3.68	6.42	4
Mean	**7.23**	**3.99**	**6.78**	**2.30**	**3.13**	**1.20**	**10.03**	**9.55**	**3.93**	**4.78**	**9.49**	**5.50**	**7.05**	**10.36**	**10.63**	**8.77**	**3.57**	**6.37**	

Table 1.4 IVTM: Initial Varietal Trial in Forage Maize: Dry matter Yield (q/ha/day)

Entries	Srina.	Ludhi.	Hisar	Pantn.	Faiza.	Bhuban.	Ranchi	Jorhat	Anand	Raipur	Jabal.	Urulika.	Hyder.	Coimb.	Karaik.	Avera.	Rank
JHM-13-1	1.03	1.10	0.40	0.80	0.09	2.05	2.38	0.58	0.54	1.93	1.72	1.69	1.81	2.04	1.15	1.29	7
BAIF Maize-3	0.97	1.00	0.42	0.87	0.13	2.31	2.03	0.94	0.57	2.18	1.49	1.75	1.55	1.69	1.45	1.29	7
AFM-3	1.01	2.20	0.46	0.67	0.52	2.49	2.39	0.67	1.34	2.63	1.14	1.79	1.92	1.36	1.48	1.47	1
AFM-2	1.02	1.90	0.48	0.47	0.32	2.55	2.29	0.83	1.06	2.10	1.45	1.73	1.68	1.52	1.20	1.37	2
PFM-7	0.92	1.20	0.74	1.04	0.37	2.41	2.17	0.78	0.79	1.98	0.99	2.03	1.30	1.80	1.23	1.32	5
AFM-1	0.94	1.40	0.57	0.76	0.50	2.33	2.29	0.67	0.82	2.38	1.26	2.27	0.92	1.43	1.59	1.34	4
J-1006 (NC)	0.95	1.10	0.32	0.86	0.39	2.15	2.16	0.78	0.65	2.40	1.43	2.00	1.37	1.46	1.57	1.31	6
African Tall (NC)	1.05	1.30	0.29	0.67	0.38	1.93	1.03	0.77	0.66	2.68	0.89	3.10	1.70	1.93	1.80	1.35	3
Mean	**0.99**	**1.40**	**0.46**	**0.77**	**0.34**	**2.28**	**2.09**	**0.75**	**0.80**	**2.29**	**1.30**	**2.05**	**1.53**	**1.65**	**1.43**	**1.34**	

Table 1.5 IVTM: Initial Varietal Trial in Forage Maize: Crude Protein Yield (q/ha)

Entries	Palam.	Ludhi.	Hisar	Faiza.	Bhuban.	Anand	Raipur	Jabal.	Rahuri	Urulika.	Hydera.	Coimb.	Karaik.	Avera.	Rank
JHM-13-1	8.0	5.4	2.9	0.5	9.3	1.8	9.1	8.6	4.4	7.6	6.2	12.2	4.6	6.2	6
BAIF Maize-3	6.4	4.8	3.1	0.7	8.7	1.6	11.6	7.6	4.4	8.6	7.1	8.3	7.8	6.2	6
AFM-3	9.5	11.6	3.8	2.7	11.0	4.4	15.3	5.6	5.0	8.3	8.9	8.5	11.7	8.2	1
AFM-2	8.6	9.2	3.6	1.6	9.7	3.0	11.4	7.3	3.7	8.7	6.0	6.9	5.5	6.6	4
PFM-7	7.8	5.5	5.6	2.0	9.0	2.2	9.9	4.7	4.2	10.4	6.0	9.7	5.6	6.4	5
AFM-1	8.6	6.2	4.3	2.9	8.5	2.5	13.4	6.3	4.1	11.0	4.0	9.0	8.3	6.9	3
J-1006 (NC)	5.9	5.1	2.6	2.1	9.0	1.9	14.4	7.4	4.3	9.0	6.7	6.1	8.8	6.4	5
African Tall (NC)	10.5	7.0	1.8	2.0	8.8	2.3	16.4	4.3	5.4	14.3	6.7	13.6	6.8	7.7	2
Mean	**8.2**	**6.8**	**3.5**	**1.8**	**9.2**	**2.5**	**12.7**	**6.5**	**4.4**	**9.7**	**6.5**	**9.3**	**7.4**	**6.8**	

Table 1.6 IVTM: Initial Varietal Trial in Forage Maize: Crude Protein (%)

Entries	Palam.	Ludhiana	Hisar	Faizabad	Bhuban.	Anand	Raipur	Jabalpur	Rahuri	Urulikan.	Hydera.	Coimba.	Karaikkal	Average	Rank
JHM-13-1	8.8	7.5	8.8	7.0	8.0	5.4	8.4	8.0	6.4	7.4	5.3	10.5	6.6	7.5	7
BAIF Maize-3	9.6	7.5	8.8	7.0	7.7	5.4	9.4	7.8	7.4	8.1	7.0	8.7	9.2	8.0	3
AFM-3	10.2	7.9	9.6	7.6	8.1	5.4	10.2	7.5	7.1	7.7	6.6	9.6	11.8	8.4	1
AFM-2	8.8	7.2	9.0	6.9	8.0	5.5	9.6	7.8	6.4	8.4	6.1	8.3	8.3	7.7	6
PFM-7	9.0	6.7	9.0	7.3	8.0	5.4	8.9	7.4	6.3	8.5	7.4	9.2	7.9	7.8	5
AFM-1	9.6	6.5	9.0	8.0	7.6	5.5	9.9	7.6	7.1	8.1	7.0	9.6	9.2	8.1	2
J-1006 (NC)	9.3	7.0	9.8	7.1	7.8	5.4	10.6	7.8	6.4	7.5	7.9	7.0	9.2	7.9	4
African Tall (NC)	10.5	7.7	7.5	7.7	7.8	5.4	10.7	7.3	7.0	7.7	6.1	11.4	5.7	7.9	4
Mean	**9.5**	**7.3**	**8.9**	**7.3**	**7.9**	**5.4**	**9.7**	**7.6**	**6.8**	**7.9**	**6.7**	**9.3**	**8.5**	**7.9**	

Table 1.7 IVTM: Initial Varietal Trial in Forage Maize: Plant Height (cm)

Entries	Palam.	Srina.	Ludhi.	Hisar	Udaip.	Pantn.	Faiza.	Bhuba.	Ranchi	Jorhat	Anand	Raipur	Jabal.	Rahuri	Urulik.	Hyder.	Coimb.	Mand.	Karaik.	Avera.	Ran.
JHM-13-1	264.0	212.0	171.7	163.9	158.6	200.0	80.5	280.3	160.4	131.8	202.6	177.9	203.1	213.9	211.6	236.6	240.0	155.4	166.7	191.1	2
BAIF Maize-3	197.3	207.8	200.7	150.3	168.7	207.6	81.2	271.7	193.7	109.7	201.2	202.6	197.1	173.1	221.0	216.4	242.2	181.6	203.9	190.9	3
AFM-3	221.6	182.5	166.3	152.8	165.7	196.3	118.7	300.3	178.2	153.6	207.6	209.5	166.1	204.1	148.4	224.3	241.8	130.7	221.1	188.9	4
AFM-2	222.0	222.1	201.7	141.0	159.2	184.3	98.5	289.0	197.8	100.5	168.4	187.0	185.1	158.1	188.1	217.8	233.1	130.7	156.5	181.1	8
PFM-7	261.3	176.7	179.0	155.2	182.6	209.0	85.2	264.4	196.4	124.1	204.2	194.2	153.0	174.1	201.0	241.9	235.4	163.4	166.3	187.8	6
AFM-1	242.0	198.6	157.7	155.7	162.9	201.6	122.5	268.7	165.3	127.2	177.9	190.9	179.2	149.9	198.3	203.9	225.9	155.6	181.6	182.4	7
J-1006 (NC)	175.6	196.7	200.0	155.8	155.6	236.6	95.4	294.7	152.2	136.9	179.2	196.1	187.7	219.1	176.9	223.6	243.6	154.0	206.5	188.7	5
African Tall (NC)	241.3	235.7	196.0	160.9	150.8	199.0	100.5	285.4	153.3	116.3	212.0	206.0	128.3	232.6	236.0	216.1	257.5	160.9	227.1	195.6	1
Mean	**228.1**	**204.0**	**184.1**	**154.5**	**163.0**	**204.3**	**97.8**	**281.8**	**174.7**	**125.0**	**194.1**	**195.5**	**175.0**	**190.6**	**197.7**	**222.6**	**239.9**	**154.0**	**191.2**	**188.3**	

Table 1.8 IVTM: Initial Varietal Trial in Forage Maize: Leaf Stem Ratio

Entries	Palam.	Srina.	Ludhi.	Hisar	Faiza.	Bhuba.	Ranchi	Jorhat	Raipur	Jabal.	Rahuri	Urulika.	Hyder.	Coimb.	Mandya	Karaik.	Avera.	Rank
JHM-13-1	0.40	0.35	0.48	0.36	0.66	1.01	0.81	1.04	0.41	0.69	0.32	0.90	0.46	0.20	0.31	0.35	0.55	3
BAIF Maize-3	0.51	0.35	0.67	0.35	0.63	0.98	0.51	0.63	0.53	0.66	0.28	1.00	0.34	0.18	0.35	0.40	0.52	4
AFM-3	0.51	0.33	0.64	0.41	0.73	1.21	0.51	1.09	0.56	0.53	0.36	0.91	0.48	0.18	0.37	0.42	0.58	1
AFM-2	0.52	0.38	0.50	0.32	0.66	1.09	0.54	0.89	0.43	0.65	0.37	1.15	0.33	0.24	0.33	0.34	0.55	3
PFM-7	0.47	0.31	0.50	0.35	0.72	0.88	0.65	0.77	0.47	0.51	0.33	0.83	0.29	0.19	0.33	0.34	0.50	6
AFM-1	0.46	0.34	0.67	0.55	0.75	0.93	0.52	0.65	0.44	0.57	0.34	0.55	0.34	0.20	0.39	0.42	0.51	5
J-1006 (NC)	0.49	0.33	0.50	0.56	0.71	1.17	0.71	0.95	0.50	0.68	0.32	0.86	0.47	0.22	0.31	0.40	0.57	2
African Tall (NC)	0.49	0.36	0.66	0.54	0.70	1.05	0.76	1.09	0.57	0.41	0.27	0.94	0.37	0.22	0.31	0.47	0.58	1
Mean	**0.48**	**0.34**	**0.58**	**0.43**	**0.70**	**1.04**	**0.63**	**0.89**	**0.49**	**0.59**	**0.32**	**0.89**	**0.39**	**0.20**	**0.34**	**0.39**	**0.54**	

Table 1.9 IVTM: Initial Varietal Trial in Forage Maize: ADF (%) , NDF (%) and IVDMD (%)

Entries	ADF (%)				NDF (%)					IVDMD (%)				
	Ludhi.	Rahuri	Average	Rank	Ludhi.	Anand	Rahuri	Average	Rank	Ludhi.	Hisar	Rahuri	Average	Rank
JHM-13-1	37.4	51.1	44.3	5	56.9	75.7	61.5	64.7	2	60.1	64.0	59.3	61.1	8
BAIF Maize-3	37.3	51.0	44.2	4	56.9	75.5	63.3	65.2	4	60.0	71.2	59.4	63.5	3
AFM-3	36.4	46.6	41.5	1	54.8	76.0	64.9	65.2	4	61.2	66.0	61.9	63.0	5
AFM-2	37.2	50.6	43.9	3	57.5	75.7	61.9	65.0	3	59.4	68.2	59.6	62.4	7
PFM-7	40.6	48.4	44.5	6	60.0	75.7	63.3	66.3	5	57.6	69.6	60.9	62.7	6
AFM-1	41.8	43.5	42.6	2	63.1	75.6	60.3	66.3	5	56.8	72.6	63.7	64.4	1
J-1006 (NC)	40.5	50.9	45.7	7	60.0	76.5	63.3	66.6	6	58.3	71.8	59.5	63.2	4
African Tall (NC)	36.7	46.2	41.5	1	55.9	75.9	61.1	64.3	1	60.3	68.8	62.2	63.8	2
Mean	**38.5**	**48.5**	**43.5**		**58.1**	**75.8**	**62.5**	**65.5**		**59.2**	**69.0**	**60.8**	**63.0**	

Table 2.1 AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize : Green Forage Yield (q/ha)

Entries	Hill Zone						North West Zone						North East Zone							All India Average		
	Palam.	Srina.	Almora.*	Aver.	Rank	Super%	Ludhi.	Hisar	Udai.	Aver.	Rank	Super%	Faiza.	Bhuba.	Ranc.	Jorh.	Aver.	Rank	Super%	Aver.	Rank	Super%
PMH-1	276.6	353.8	398.4	315.2	4		397.9	139.6	183.3	240.3	4		96.5	471.9	169.3	190.3	232.0	2	9.3	253.2	3	1.1
PMH-3	335.6	372.6	463.0	354.1	1	11.8	343.8	172.9	237.5	251.4	3		107.8	412.9	178.4	192.3	222.9	4	5.0	261.5	2	4.4
DHM-117	327.5	339.4	373.0	333.5	2	5.3	281.3	177.9	201.0	220.1	5		116.1	390.8	177.1	210.3	223.6	3	5.3	246.8	5	
IHTFM (PAC-745)	293.7	322.8	405.5	308.3	5		650.0	129.6	254.2	344.6	1	29.6	118.3	407.2	203.1	221.4	237.5	1	11.9	288.9	1	15.4
J-1006 (NC)	249.0	384.6	364.7	316.8	3		402.1	145.0	250.0	265.7	2		55.5	370.6	177.1	219.4	205.6	6		250.4	4	
African Tall (NC)	255.9	348.4	433.0	302.2	6		251.3	135.0	194.8	193.7	6		111.5	389.3	151.0	197.3	212.3	5		226.1	6	
Mean	**289.7**	**353.6**	**406.3**	**321.7**			**387.7**	**150.0**	**220.1**	**252.6**			**100.9**	**407.1**	**176.0**	**205.2**	**222.3**			**254.5**		
CD at 5%	34.9	2.7	N.S.				58.1	NS	56.4				14.5	20.8	27.3	5.4						
CV%	7.9	1.0	22.0				6.9	19.2	14.6				9.5	4.3	10.2	10.3						

***not included in zonal and all india average due to cv>20**

Table 2.2 AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize : Dry Matter Yield (q/ha)

Entries	Hill Zone						North West Zone					North East Zone							All India Average		
	Palam.	Srina.	Almora*	Avera.	Rank	Super%	Ludhi.	Hisar	Avera.	Rank	Super%	Faiza.	Bhuba.	Ranc.	Jorhat	Avera.	Rank	Super%	Avera.	Rank	Super%
PMH-1	50.5	72.4	96.7	61.5	4		92.3	26.2	59.3	2	2.2	29.1	109.2	33.8	38.2	52.6	2	15.4	56.5	2	6.2
PMH-3	63.6	78.5	117.3	71.1	1	11.3	72.1	35.1	53.6	4		25.1	95.6	33.6	34.3	47.1	4	3.3	54.7	3	2.8
DHM-117	62.2	68.9	83.7	65.6	2	2.7	60.5	34.6	47.6	5		36.5	88.2	37.8	41.1	50.9	3	11.6	53.7	4	0.9
IHTFM (PAC-745)	55.5	66.1	98.5	60.8	5		151.8	28.6	90.2	1	55.5	37.1	92.5	47.8	43.2	55.1	1	20.8	65.3	1	22.7
J-1006 (NC)	47.7	80.1	82.6	63.9	3		83.3	32.6	58.0	3		16.1	84.4	39.0	42.9	45.6	5		53.2	5	
African Tall (NC)	47.3	72.8	86.7	60.1	6		48.6	28.1	38.4	6		27.6	89.9	24.8	33.2	43.9	6		46.5	6	
Mean	**54.5**	**73.1**	**94.3**	**63.8**			**84.8**	**30.9**	**57.8**			**28.6**	**93.3**	**36.1**	**38.8**	**49.2**			**55.0**		
CD at 5%	7.9	2.1	N.S.				48.8	NS				4.4	5.0	7.7	1.5						
CV%	9.6	1.9	26.0				11.5	18.4				10.3	4.5	14.1	6.6						

***not included in zonal and all india average due to cv>20**

Table 2.3 AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize : Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	Green Forage Yield (q/ha/day)										Dry Matter Yield (q/ha/day)								
	Palam.	Srina.	Ludhi.	Hisar	Faiza.	Bhuban.	Ranc.	Jorhat	Avera.	Rank	Srina.	Ludhi.	Hisar	Faiza.	Bhuban.	Ranc.	Jorhat	Avera.	Rank
PMH-1	4.37	4.72	5.90	1.66	1.38	9.39	3.19	2.84	4.18	2	0.94	1.40	0.31	0.42	2.17	0.64	0.57	0.92	2
PMH-3	5.20	5.00	5.10	2.06	1.66	7.90	3.24	2.87	4.13	3	1.05	1.10	0.42	0.39	1.83	0.61	0.51	0.84	3
DHM-117	4.92	4.79	4.20	2.12	1.63	7.34	2.95	3.14	3.89	4	0.85	0.90	0.41	0.51	1.66	0.63	0.61	0.80	5
IHTFM (PAC-745)	4.76	4.40	9.70	1.54	1.67	8.35	3.76	3.51	4.71	1	0.83	2.30	0.34	0.50	1.90	0.89	0.68	1.06	1
J-1006 (NC)	3.69	5.10	6.00	1.73	0.82	6.86	3.16	3.27	3.83	5	1.07	1.20	0.39	0.24	1.56	0.70	0.64	0.83	4
African Tall (NC)	3.82	4.69	3.80	1.61	1.55	6.52	2.65	2.86	3.44	6	0.97	0.70	0.33	0.38	1.50	0.43	0.48	0.68	6
Mean	**4.46**	**4.78**	**5.78**	**1.79**	**1.45**	**7.73**	**3.16**	**3.08**	**4.03**		**0.95**	**1.27**	**0.37**	**0.41**	**1.77**	**0.65**	**0.58**	**0.86**	

Table 2.4 AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize : Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)							Crude Protein (%)						
	Palam.	Ludhiana	Faizabad	Bhuban.	Hisar	Avera.	Rank	Palam.	Ludhiana	Faizabad	Bhuban.	Hisar	Avera.	Rank
PMH-1	5.3	6.9	1.9	8.8	2.1	5.0	2	10.5	7.5	6.6	8.0	7.9	8.1	4
PMH-3	7.2	4.2	2.0	7.6	3.5	4.9	3	11.4	5.8	7.9	7.9	9.9	8.6	1
DHM-117	6.5	3.8	3.0	6.8	2.9	4.6	4	10.5	6.3	8.2	7.7	8.3	8.2	3
IHTFM (PAC-745)	5.3	10.1	3.1	7.6	2.3	5.7	1	9.6	6.7	8.5	8.2	8.1	8.2	3
J-1006 (NC)	4.5	6.0	1.1	6.9	2.5	4.2	5	9.4	7.2	6.9	8.1	7.7	7.8	5
African Tall (NC)	5.1	3.6	2.0	7.2	2.4	4.1	6	10.7	7.4	7.3	8.0	8.5	8.4	2
Mean	**5.7**	**5.8**	**2.2**	**7.5**	**2.6**	**4.7**		**10.4**	**6.8**	**7.5**	**8.0**	**8.4**	**8.2**	

Table 2.5 AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize : Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)											Leaf Stem Ratio									
	Palam.	Srina.	Ludhi.	Hisar	Udaip.	Faiza.	Bhuban.	Ranc.	Jorhat	Avera.	Rank	Palam.	Srina.	Ludhi.	Hisar	Faiza.	Bhuban.	Ranc.	Jorhat	Avera.	Rank
PMH-1	225.2	246.5	194.5	152.9	139.8	95.6	312.0	131.9	126.8	180.6	4	0.31	0.38	0.53	0.47	0.65	1.23	0.67	0.95	0.65	3
PMH-3	233.7	256.3	178.8	142.3	146.6	115.2	306.5	149.5	121.1	183.3	3	0.43	0.39	0.50	0.42	0.75	1.18	0.63	0.96	0.66	2
DHM-117	183.2	236.8	158.8	145.8	138.2	125.6	298.6	154.1	136.1	175.2	6	0.43	0.35	0.44	0.49	0.71	1.08	0.61	1.08	0.65	3
IHTFM (PAC-745)	242.0	230.8	173.0	142.3	162.3	130.5	303.6	151.6	133.8	185.5	2	0.34	0.34	0.70	0.35	0.78	1.12	0.62	1.00	0.66	2
J-1006 (NC)	212.0	255.5	202.0	158.2	148.4	98.7	284.7	136.5	123.3	179.9	5	0.36	0.42	0.60	0.41	0.68	0.97	0.66	1.04	0.64	4
African Tall (NC)	225.0	245.5	220.0	182.4	142.3	105.4	289.8	140.0	144.2	188.3	1	0.44	0.37	0.38	0.56	0.69	1.03	0.91	1.14	0.69	1
Mean	**220.2**	**245.2**	**187.9**	**154.0**	**146.3**	**111.8**	**299.2**	**143.9**	**130.9**	**182.1**		**0.39**	**0.38**	**0.53**	**0.45**	**0.71**	**1.10**	**0.68**	**1.03**	**0.66**	

Table 2.6 AVTHM-1: First Advanced Varietal Trial in Forage Hybrid Maize : ADF (%) & NDF (%) & IVDMD (%)

Entries	ADF (%)				NDF (%)				IVDMD (%)			
	Palampur	Ludhiana	Average	Rank	Palampur	Ludhiana	Average	Rank	Ludhiana	Hisar	Average	Rank
PMH-1	51.4	31.8	41.6	2	70.0	54.2	62.1	1	59.0	53.4	56.2	6
PMH-3	52.2	38.5	45.4	6	68.0	62.7	65.4	6	56.2	57.8	57.0	4
DHM-117	48.8	37.3	43.1	4	67.8	61.1	64.5	4	57.6	56.7	57.2	3
IHTFM (PAC-745)	50.4	37.2	43.8	5	70.4	60.0	65.2	5	57.8	56.0	56.9	5
J-1006 (NC)	51.8	31.6	41.7	3	69.4	57.4	63.4	2	59.8	54.8	57.3	2
African Tall (NC)	49.2	32.5	40.9	1	72.2	56.5	64.4	3	60.0	54.8	57.4	1
Mean	**50.6**	**34.8**	**42.7**		**69.6**	**58.7**	**64.1**		**58.4**	**55.6**	**57.0**	

3. IVTPM: Initial Varietal Trial in Forage Pearl millet

An initial varietal trial in forage pearl millet comprising five entries and three national checks namely Raj Bajra Chari-2, Giant Bajra and AVKB-19 was conducted at 18 locations distributed in four zones. For green forage yield (q/ha), entries DFMH-30 (9.5%), NDFB-939 (7.6%) and AFB-9 (6.7%) in North West zone; entries NDFB-939 (5.9%), AFB-9 (4.8%) and DFMH-30 (3.3%) in North East zone, DFMH-30 (3.0%) in Central zone and DFMH-30 (3.7%) in South zone exhibited superiority over best national check. At national level, entry DFMH-30 with 8.9 per cent superiority was best performer.

For dry matter yield (q/ha), entries NDFB-939 (24.8%), AFB-9 (16.7%), DFMH-30 (13.6%) and RBB-4 (4.4%) in North West zone; entries AFB-9 (7.1%) and NDFB-939 (6.7%) in North East zone and DFMH-30 (13.8%) in South zone exhibited their superiority over checks. At national level, DFMH-30 (14.6%) was best performer, followed by AFB-9 (8.2%) and NDFB-939 (7.6%).

For fodder production potential (q/ha/day), entry DFMH-30 for green forage yield and dry matter yield registered its superiority. For plant height, entry DFMH-30 (201.5 cm) was adjudged best performer. For the character leafiness, entry NDFB-939 was ranked first. For quality parameters, entry DFMH-30 for crude protein yield and AFB-9 for crude protein content (%) proved superiority.

For other quality parameters, entry HFP-12-3 for ADF (%) and IVDMD (%) and AFB-9 for NDF (%) were best performers. **(Table Reference: 3.1 to 3.9)**

4. AVTPM-1: First Advanced Varietal Trial in Forage Pearl Millet

In forage pearl millet, three entries namely AFB-8, NDFB-936 and APFB-09-1 along with three national checks *i.e.* Raj Bajra Chari-2, Giant Bajra and AVKB-19 were evaluated in first advanced varietal trial conducted at six locations distributed in north east zone.

AFB-8 (1.3%) in north east zone exhibited superiority over best national check for green forage yield (q/ha). Similarly for dry matter yield (q/ha), AFB-8 (10.0%) and APFB-09-1 (3.5%) registered superiority over best national check. For fodder production potential (q/ha/day), entry AFB-8 maintained superiority both for green forage and dry matter production potential. For plant height, AFB-8 (199.5 cm) ranked first whereas for leaf stem ratio, check variety Giant Bajra (0.81) established its superiority.

In quality parameters, entry APFB-09-1 ranked first for crude protein yield (q/ha) as well as crude protein content. **(Table Reference: 4.1 to 4.4)**

Table 3.1 IVTPM : Initial Varietal Trial in Forage Pearl millet : Green Forage Yield (q/ha)

Entries	North West Zone							North East Zone							Central Zone								
	Ludhi.	Hisar	Bikan.	Jalore	Avera.	Rank	Super%	Faiza.	Pusa	Bhuban.	Ranc.	Avera.	Rank	Super%	Anand	Jabal.	Rahuri	Urulik.	Jhansi	Jamna.	Avera.	Rank	Super%
HFP-12-3	226.9	172.0	405.2	345.0	287.3	8		236.1		604.9	481.4	440.8	7		575.0	210.3	254.1	682.1	199.0	252.6	362.2	6	
RBB-4	463.0	111.7	408.9	355.0	334.6	5		187.1	533.0	551.6	500.0	442.9	6		624.0	341.6	234.0	690.3	143.0	213.7	374.4	4	
NDFB-939	627.3	172.2	403.1	325.0	381.9	2	7.6	328.4	555.0	593.7	527.8	501.2	1	5.9	557.0	258.3	259.7	551.4	306.0	241.3	362.3	5	
AFB-9	597.2	127.8	406.4	384.3	378.9	3	6.7	312.9	499.0	617.0	555.6	496.1	2	4.8	618.0	289.5	271.5	673.9	190.0	213.2	376.0	3	
DFMH-30	567.1	222.2	362.3	403.3	388.7	**1**	9.5	326.0	522.0	623.2	485.3	489.1	3	3.3	647.0	387.4	368.0	939.4	115.0	331.6	464.7	1	3.0
Giant Bajra (NC)	294.0	163.3	407.4	448.3	328.3	6		303.9	511.0	549.9	333.3	424.5	8		585.0	256.2	474.9	894.5	287.0	208.1	451.0	2	
AVKB-19 (NC)	409.7	134.4	316.1	370.0	307.5	7		187.9	522.0	586.2	490.8	446.7	5		563.0	335.3	235.4	551.4	111.0	201.0	332.9	8	
Raj Bajra Chari-2 (NC)	439.8	274.6	370.6	335.0	355.0	4		305.6	588.0	536.2	463.1	473.2	4		557.0	285.3	253.4	653.5	157.0	205.9	352.0	7	
Mean	**453.1**	**172.3**	**385.0**	**370.7**	**345.3**			**273.5**	**532.9**	**582.8**	**479.7**	**464.3**			**590.8**	**295.5**	**293.9**	**704.6**	**188.5**	**233.4**	**384.4**		
CD at 5%	34.4	44.5	48.4	41.9				68.7	42.7	49.9	103.6				52.7	68.9	26.7	22.0	42.0	56.9			
CV%	6.0	14.6	7.2	6.4				14.4	8.6	4.9	12.2				5.1	13.3	5.2	19.4	12.7	14.7			

Entries	South Zone							All India		
	Hyderabad	Coimbatore	Mandya	Karaikkal	Average	Rank	Superiority%	Average	Rank	Superiority%
HFP-12-3	247.2	287.0	164.3	382.3	270.2	8		336.8	8	
RBB-4	326.4	291.7	157.5	421.9	299.4	7		364.1	6	
NDFB-939	407.4	384.3	132.4	527.8	363.0	3		397.7	3	
AFB-9	430.6	273.1	216.1	472.3	348.0	4		397.1	4	
DFMH-30	575.0	296.3	241.6	415.5	382.1	1	3.7	434.9	1	8.9
Giant Bajra (NC)	384.3	416.7	221.5	451.2	368.4	2		399.5	2	
AVKB-19 (NC)	361.1	268.5	208.3	461.3	324.8	5		350.7	7	
Raj Bajra Chari-2 (NC)	342.6	310.2	156.9	443.1	313.2	6		371.0	5	
Mean	**384.3**	**316.0**	**187.3**	**446.9**	**333.6**			**381.5**		
CD at 5%	25.3	45.4	31.7	42.7						
CV%	3.8	8.2	9.7	5.5						

Table 3.2 IVTPM : Initial Varietal Trial in Forage Pearl millet : Dry Matter Yield (q/ha)

Entries	North West Zone						North East Zone							Central Zone							
	Ludhi.	Hisar	Bikan.	Avera.	Rank	Super%	Faiza.	Pusa	Bhuban.	Ranchi	Avera.	Rank	Super%	Anand	Jabal.	Rahuri	Urulika.	Jhansi	Jamna.*	Avera.	Rank
HFP-12-3	47.5	27.5	112.2	62.4	6		67.8		134.4	131.7	111.3	5		71.2	47.0	47.7	136.4	27.7	51.2	66.0	7
RBB-4	96.3	17.9	118.2	77.5	4	4.4	42.9	123.0	122.6	135.6	106.0	6		101.6	82.4	48.6	143.3	28.7	51.5	80.9	3
NDFB-939	140.6	26.2	111.1	92.6	1	24.8	101.3	129.0	132.5	144.7	126.9	2	6.7	71.8	59.7	47.5	118.5	57.5	53.7	71.0	6
AFB-9	136.7	22.7	100.5	86.6	2	16.7	95.6	114.0	133.5	166.7	127.4	1	7.1	109.9	68.9	51.6	133.5	35.9	40.5	80.0	4
DFMH-30	133.5	40.9	78.5	84.3	3	13.6	96.4	121.0	140.5	115.3	118.3	4		97.0	93.9	64.5	184.6	25.3	51.3	93.1	2
Giant Bajra (NC)	67.1	25.7	81.2	58.0	8		85.8	118.0	121.2	70.8	99.0	8		94.1	59.1	92.4	176.4	44.8	67.1	93.4	1
AVKB-19 (NC)	75.6	20.0	87.3	61.0	7		45.8	116.0	127.3	134.7	105.9	7		67.6	80.6	46.4	98.9	22.6	49.5	63.2	8
Raj Bajra Chari-2 (NC)	92.7	36.3	93.5	74.2	5		93.1	130.0	117.9	134.7	118.9	3		83.5	67.7	50.9	138.2	34.8	49.8	75.0	5
Mean	**98.8**	**27.2**	**97.8**	**74.6**			**78.6**	**121.6**	**128.7**	**129.3**	**114.2**			**87.1**	**69.9**	**56.2**	**141.2**	**34.7**	**51.8**	**77.8**	
CD at 5%	17.4	8.6	15.4				18.6	8.3	12.9	28.3				8.0	16.5	5.2	7.1	7.5	22.5		
CV%	7.3	18.0	9.0				13.5	9.1	5.7	12.3				5.4	13.6	5.2	19.2	12.4	24.7		

Entries	South Zone							All India		
	Hyderabad	Coimbatore	Mandya	Karaikkal	Average	Rank	Superiority%	Average	Rank	Superiority%
HFP-12-3	44.8	59.1	36.9	75.5	54.1	8		71.2	8	
RBB-4	73.6	55.0	35.9	63.6	57.0	6		80.6	6	
NDFB-939	76.3	77.2	33.2	107.0	73.4	3		89.6	3	7.6
AFB-9	87.7	55.8	45.2	83.0	67.9	4		90.1	2	8.2
DFMH-30	133.4	62.3	50.8	89.7	84.1	1	13.8	95.5	1	14.6
Giant Bajra (NC)	77.9	80.6	46.8	90.5	73.9	2		83.3	4	
AVKB-19 (NC)	75.6	52.5	43.4	64.7	59.1	5		72.4	7	
Raj Bajra Chari-2 (NC)	73.1	60.7	32.2	60.1	56.5	7		81.2	5	
Mean	**80.3**	**62.9**	**40.6**	**79.3**	**65.8**			**81.1**		
CD at 5%	12.9	13.6	7.9	5.7						
CV%	9.2	12.3	11.1	4.1						

***not included in zonal and all india average due to cv>20**

Table 3.3 IVTPM : Initial Varietal Trial in Forage Pearl millet : Green Forage Yield (q/ha/day)

Entries	Ludhi.	Hisar	Bikan.	Faiza.	Pusa	Bhuban.	Ranchi	Anand	Jabal.	Rahuri	Urulikan.	Jhansi	Jamna.	Hydera.	Coimba.	Mandya	Avera.	Rank
HFP-12-3	3.40	2.05	6.99	3.63		14.63	10.03	11.06	3.18	4.98	11.00	3.06	4.65	4.27	6.11	4.62	6.24	7
RBB-4	6.90	1.33	7.05	2.71	8.33	13.13	10.87	11.35	5.25	5.20	11.13	2.42	3.98	6.08	6.48	3.95	6.64	4
NDFB-939	9.40	2.05	6.95	4.98	8.67	12.91	10.13	10.13	4.03	5.90	8.89	4.93	4.47	7.28	8.35	3.12	7.01	3
AFB-9	8.90	1.52	7.01	4.67	7.92	14.02	10.89	10.30	4.38	6.31	10.87	3.06	3.88	8.33	6.07	5.24	7.09	2
DFMH-30	8.50	2.65	6.25	5.17	8.42	11.76	8.82	10.61	5.96	7.36	15.15	2.05	5.75	11.47	6.30	5.29	7.59	**1**
Giant Bajra (NC)	4.40	1.94	5.29	4.60	8.11	9.01	5.38	9.00	3.88	8.05	14.43	4.22	3.07	6.85	7.18	4.92	6.27	6
AVKB-19 (NC)	6.10	1.60	5.45	2.68	8.29	13.12	10.02	10.83	5.15	4.80	8.89	1.95	3.64	6.23	5.97	5.53	6.27	6
Raj Bajra Chari-2 (NC)	6.60	3.27	6.39	4.49	9.05	12.09	9.26	10.71	4.32	4.87	10.54	2.71	3.70	7.09	6.74	3.45	6.58	5
Mean	**6.78**	**2.05**	**6.42**	**4.12**	**8.40**	**12.58**	**9.43**	**10.50**	**4.52**	**5.94**	**11.36**	**3.05**	**4.14**	**7.20**	**6.65**	**4.52**	**6.71**	

Table 3.4 IVTPM : Initial Varietal Trial in Forage Pearl millet : Dry Matter Yield (q/ha/day)

Entries	Ludhia.	Hisar	Bikaner	Faiza.	Pusa	Bhuban.	Ranchi	Anand	Jabalpur	Urulikan.	Jhansi	Hydera.	Coimba.	Karaik.	Avera.	Rank
HFP-12-3	0.70	0.33	1.93	1.04		3.25	2.74	1.37	0.71	2.20	0.43	0.78	1.26	1.91	1.43	6
RBB-4	1.40	0.21	2.04	0.62	1.92	2.92	2.95	1.85	1.26	2.31	0.49	1.37	1.22	1.66	1.59	4
NDFB-939	2.10	0.31	1.92	1.53	2.02	2.88	2.78	1.31	0.93	1.91	0.93	1.37	1.68	2.55	1.73	2
AFB-9	2.00	0.27	1.73	1.42	1.81	3.03	3.27	1.83	1.04	2.15	0.58	1.70	1.24	2.01	1.72	3
DFMH-30	2.00	0.49	1.35	1.53	1.95	2.65	2.10	1.59	1.44	2.98	0.45	2.66	1.33	2.06	1.76	**1**
Giant Bajra (NC)	1.00	0.31	1.05	1.30	1.87	1.99	1.14	1.45	0.89	2.84	0.66	1.39	1.39	2.04	1.38	8
AVKB-19 (NC)	1.10	0.24	1.50	0.65	1.84	2.85	2.75	1.30	1.24	1.60	0.40	1.31	1.17	1.67	1.40	7
Raj Bajra Chari-2 (NC)	1.40	0.43	1.61	1.37	2.00	2.66	2.69	1.61	1.02	2.23	0.60	1.51	1.32	1.53	1.57	5
Mean	**1.46**	**0.32**	**1.64**	**1.18**	**1.92**	**2.78**	**2.55**	**1.54**	**1.07**	**2.28**	**0.57**	**1.51**	**1.32**	**1.93**	**1.57**	

Table 3.5 IVTPM : Initial Varietal Trial in Forage Pearl millet : Crude Protein Yield (q/ha)

Entries	Ludhiana	Faizabad	Bhuban.	Anand	Jabalpur	Rahuri	Urulikan.	Hisar	Hydera.	Coimba.	Karaikkal	Average	Rank
HFP-12-3	12.4	5.4	10.2	8.5	3.4	3.3	11.9	2.2	2.6	7.0	9.6	6.9	5
RBB-4	7.6	3.4	9.0	11.0	6.5	3.5	12.7	1.5	3.2	6.0	8.1	6.6	6
NDFB-939	7.2	8.7	10.0	7.0	4.5	3.5	11.0	2.1	4.3	7.8	13.1	7.2	3
AFB-9	6.1	7.9	10.0	11.5	5.2	3.3	13.3	1.8	4.8	5.4	9.8	7.2	3
DFMH-30	8.9	7.9	10.4	8.4	7.5	4.9	16.4	3.5	7.1	6.3	9.0	8.2	**1**
Giant Bajra (NC)	6.9	5.8	8.9	13.1	4.3	6.7	15.9	2.1	4.1	8.8	9.0	7.8	2
AVKB-19 (NC)	6.4	3.4	9.6	8.0	6.3	2.8	9.6	1.8	4.0	6.2	8.5	6.1	7
Raj Bajra Chari-2 (NC)	7.9	8.1	8.7	8.9	5.1	4.0	13.3	3.2	4.2	6.4	6.8	7.0	4
Mean	**7.9**	**6.3**	**9.6**	**9.6**	**5.3**	**4.0**	**13.0**	**2.3**	**4.3**	**6.7**	**9.3**	**7.1**	

Table 3.6 IVTPM : Initial Varietal Trial in Forage Pearl millet : Crude Protein (%)

Entries	Ludhiana	Faizabad	Bhuban.	Anand	Jabalpur	Rahuri	Urulika.	Jhansi	Hisar	Hydera.	Coimb.	Mandya	Karaik.	Avera.	Rank
HFP-12-3	8.8	7.9	7.6	12.0	7.2	6.9	8.1	10.6	8.1	5.7	11.8	5.0	12.7	8.6	2
RBB-4	7.0	7.8	7.4	10.8	7.9	7.1	8.9	9.1	8.1	4.4	10.9	5.5	12.7	8.3	4
NDFB-939	7.7	8.6	7.6	9.8	7.6	7.3	10.1	10.2	8.1	5.7	10.1	4.8	12.3	8.4	3
AFB-9	5.8	8.3	7.5	10.5	7.6	6.4	10.0	10.8	8.1	5.6	9.6	10.9	11.8	8.7	1
DFMH-30	7.2	8.2	7.4	8.7	8.0	7.6	8.9	11.2	8.5	5.3	10.1	4.8	10.1	8.2	5
Giant Bajra (NC)	5.8	6.7	7.3	13.9	7.3	7.3	9.0	9.8	8.3	5.3	10.9	7.4	10.1	8.4	3
AVKB-19 (NC)	6.0	7.5	7.6	11.9	7.9	6.1	9.7	11.5	9.2	5.3	11.8	4.4	13.1	8.6	2
Raj Bajra Chari-2 (NC)	8.2	8.7	7.3	10.6	7.6	7.9	9.6	10.8	8.8	5.7	10.5	5.3	11.4	8.6	2
Mean	**7.1**	**8.0**	**7.5**	**11.0**	**7.6**	**7.1**	**9.3**	**10.5**	**8.4**	**5.4**	**10.7**	**6.0**	**11.8**	**8.5**	

Table 3.7 IVTPM : Initial Varietal Trial in Forage Pearl millet : Plant Height (cm)

Entries	Ludhia.	Hisar	Bikan.	Faiza.	Bhuban.	Ranchi	Anand	Jabal.	Rahuri	Urulika.	Jhansi	Jamna.	Hyder.	Coimba.	Mandya	Karaik.	Avera.	Rank
HFP-12-3	208.7	175.2	121.1	172.4	306.5	200.4	213.1	135.0	161.8	206.6	167.0	164.8	173.9	214.9	174.3	179.2	185.9	8
RBB-4	214.3	178.0	119.1	170.5	291.6	189.1	222.9	180.4	155.6	220.4	177.0	171.5	156.0	212.1	159.2	195.4	188.3	6
NDFB-939	207.3	181.2	118.5	199.7	297.7	204.2	213.2	151.0	165.3	213.0	197.0	166.9	164.5	194.7	169.4	231.5	192.2	3
AFB-9	173.7	188.9	117.8	184.5	311.1	192.4	226.0	165.3	153.9	230.0	169.0	166.8	174.3	218.0	182.1	185.8	190.0	4
DFMH-30	187.0	190.2		198.5	314.2	194.4	233.2	185.0	156.3	247.3	187.0	175.7	183.9	209.4	172.9	187.5	201.5	1
Giant Bajra (NC)	180.0	196.2	119.6	185.6	284.7	196.1	241.7	148.0	176.5	249.8	181.0	152.7	202.3	213.1	185.9	257.0	198.1	2
AVKB-19 (NC)	173.3	166.4	119.1	164.5	293.1	198.8	217.5	174.3	172.0	222.0	188.0	173.5	171.2	205.8	180.1	177.0	187.3	7
Raj Bajra Chari-2 (NC)	239.0	177.8	117.6	190.6	279.3	188.3	221.4	158.4	152.7	221.7	191.0	168.2	163.3	204.0	172.5	169.4	188.4	5
Mean	**197.9**	**181.7**	**119.0**	**183.3**	**297.3**	**195.5**	**223.6**	**162.2**	**161.8**	**226.4**	**182.1**	**167.5**	**173.7**	**209.0**	**174.5**	**197.9**	**191.5**	

Table 3.8 IVTPM : Initial Varietal Trial in Forage Pearl millet : Leaf stem ratio

Entries	Ludhia.	Hisar	Bikan.	Faiza.	Pusa	Bhuban.	Ranchi	Jabal.	Rahu.	Urulika.	Jhansi	Jamna.	Hyder.	Coimba.	Mandya	Karaik.	Anand	Avera.	Rank
HFP-12-3	0.67	0.43	0.30	0.68		1.21	0.28	0.39	0.18	0.52	0.31	0.68	0.21	0.19	0.25	0.20	0.68	0.45	6
RBB-4	0.66	0.41	0.26	0.65	0.98	0.97	0.28	0.67	0.26	0.49	0.34	0.51	0.23	0.23	0.21	0.20	0.51	0.46	5
NDFB-939	0.64	0.49	0.25	0.72	1.02	1.15	0.31	0.50	0.19	0.47	0.41	0.92	0.24	0.21	0.18	0.25	0.92	0.52	1
AFB-9	0.50	0.33	0.20	0.70	0.96	1.26	0.25	0.58	0.24	0.63	0.27	0.84	0.22	0.25	0.22	0.18	0.84	0.50	3
DFMH-30	0.67	0.51	0.24	0.71	0.99	1.32	0.37	0.71	0.23	0.52	0.26	0.66	0.18	0.21	0.18	0.20	0.66	0.51	2
Giant Bajra (NC)	0.48	0.49	0.44	0.72	0.96	0.88	0.43	0.52	0.32	0.53	0.25	0.57	0.22	0.21	0.22	0.24	0.57	0.47	4
AVKB-19 (NC)	0.50	0.46	0.24	0.67	0.98	1.07	0.25	0.66	0.24	0.68	0.92	0.59	0.19	0.25	0.23	0.20	0.59	0.51	2
Raj Bajra Chari-2 (NC)	0.50	0.44	0.35	0.73	0.99	0.86	0.26	0.54	0.24	0.45	0.20	0.57	0.20	0.18	0.21	0.20	0.57	0.44	7
Mean	**0.58**	**0.45**	**0.29**	**0.70**	**0.98**	**1.09**	**0.30**	**0.57**	**0.24**	**0.54**	**0.37**	**0.67**	**0.21**	**0.22**	**0.21**	**0.21**	**0.67**	**0.48**	

Table 3.9 IVTPM : Initial Varietal Trial in Forage Pearl millet : ADF (%), NDF (%) & IVDMD (%)

Entries	ADF (%)					NDF (%)						IVDMD (%)				
	Ludhia.	Rahuri	Jhansi	Average	Rank	Ludhia.	Anand	Rahuri	Jhansi	Average	Rank	Ludhia.	Rahuri	Hisar	Average	Rank
HFP-12-3	35.8	39.8	39.2	38.3	1	53.1	81.0	63.5	68.5	66.5	2	59.8	57.9	44.0	53.9	1
RBB-4	37.8	41.9	40.1	39.9	2	58.8	77.0	67.9	68.4	68.0	7	57.6	56.3	39.4	51.1	4
NDFB-939	37.5	54.3	40.9	44.2	7	55.2	78.0	64.7	68.3	66.6	3	59.0	46.6	40.6	48.7	7
AFB-9	41.6	47.9	41.0	43.5	6	61.8	66.0	64.3	70.9	65.8	1	56.2	51.6	39.2	49.0	6
DFMH-30	40.6	43.5	39.2	41.1	3	55.8	82.0	64.4	68.1	67.6	5	58.8	55.0	41.2	51.7	2
Giant Bajra (NC)	41.6	43.2	40.2	41.7	5	61.7	81.0	65.6	71.1	69.9	8	56.0	55.2	42.4	51.2	3
AVKB-19 (NC)	40.8	52.1	39.6	44.2	7	59.9	77.0	66.0	68.3	67.8	6	57.0	48.3	40.0	48.4	8
Raj Bajra Chari-2 (NC)	37.0	47.6	40.1	41.6	4	54.2	79.0	64.3	69.6	66.8	4	59.2	51.8	39.2	50.1	5
Mean	**39.1**	**46.3**	**40.0**	**41.8**		**57.6**	**77.6**	**65.1**	**69.2**	**67.4**		**58.0**	**52.9**	**50.5**	**50.5**	

Table 4.1 AVTPM-1 First Advanced Varietal Trial in Forage Pearl millet : Green Forage Yield (q/ha) and Dry Matter Yield (q/ha)

Entries	Green Forage Yield (q/ha)									Dry Matter Yield (q/ha)								
	North-East Zone									North-East Zone								
	Faizab.	Pusa	Bhuban.	Ranchi	Kalya.	Jorhat	Avera.	Rank	Superi%	Faiza.	Pusa	Bhuban.	Ranchi	Kalya.	Jorhat	Avera.	Rank	Superi%
AFB-8	223.7	555.0	472.8	221.4	237.9	100.6	301.9	1	1.3	60.4	129.0	105.7	63.8	36.0	19.1	69.0	1	10.0
NDFB-936	126.8	499.0	425.4	200.5	267.9	108.9	271.4	5		38.8	113.0	95.7	49.5	39.2	20.7	59.5	5	
APFB-09-1	246.9	544.0	432.7	192.8	214.6	111.4	290.4	3		74.1	123.0	97.8	42.8	31.9	20.0	64.9	2	3.5
AVKB-19 (NC)	215.7	488.0	409.5	203.1	202.7	108.4	271.2	6		52.7	110.0	90.0	53.8	30.4	20.0	59.5	5	
Giant Bajra (NC)	224.6	555.0	469.7	250.0	205.2	83.8	298.0	2		48.4	126.0	103.0	48.2	29.0	16.4	61.8	4	
Raj Bajra Chari-2 (NC)	243.6	566.0	328.1	197.9	282.7	84.7	283.8	4		69.5	131.0	71.3	47.9	42.4	13.9	62.7	3	
Mean	**213.5**	**534.5**	**423.0**	**211.0**	**235.2**	**99.6**	**286.1**			**57.3**	**122.0**	**93.9**	**51.0**	**34.8**	**18.4**	**62.9**		
CD at 5%	26.5	39.1	22.5	30.2	10.5	2.9				11.9	7.8	6.5	9.7	2.6	1.6			
CV%	8.3	9.7	3.5	9.4	3.0	7.9				10.8	8.4	4.6	12.5	4.8	9.9			

Table 4.2 AVTPM-1 First Advanced Varietal Trial in Forage Pearl millet : Green Forage Yield (q/ha/day) and Dry Matter Yield (q/ha/day)

Entries	Green Forage Yield (q/ha/day)								Dry Matter Yield (q/ha/day)							
	Faizabad	Pusa	Bhuban.	Ranchi	Kalyani	Jorhat	Average	Rank	Faizabad	Pusa	Bhuban.	Ranchi	Kalyani	Jorhat	Average	Rank
AFB-8	3.19	8.81	10.01	4.26	4.10	1.54	5.32	1	0.86	2.04	2.24	1.23	0.62	0.29	1.21	1
NDFB-936	1.84	7.92	10.07	3.71	4.62	1.65	4.97	3	0.56	1.79	2.27	0.92	0.68	0.31	1.09	3
APFB-09-1	3.47	8.50	8.40	3.01	3.83	1.71	4.82	5	1.04	1.92	1.90	0.67	0.57	0.31	1.07	5
AVKB-19 (NC)	3.04	7.63	9.93	3.63	3.69	1.81	4.95	4	0.74	1.72	2.18	0.96	0.55	0.33	1.08	4
Giant Bajra (NC)	3.12	8.67	8.06	3.79	3.73	1.20	4.76	6	0.67	1.97	1.77	0.73	0.53	0.23	0.98	6
Raj Bajra Chari-2 (NC)	3.48	8.84	8.58	3.88	5.05	1.21	5.17	2	0.99	2.05	1.86	0.94	0.76	0.20	1.13	2
Mean	**3.02**	**8.40**	**9.18**	**3.71**	**4.17**	**1.52**	**5.00**		**0.81**	**1.92**	**2.04**	**0.91**	**0.62**	**0.28**	**1.09**	

Table 4.3AVTPM-1 First Advanced Varietal Trial in Forage Pearl millet : Crude Protein Yield (q/ha) & CP(%)

Entries	Crude Protein Yield (q/ha)					CP(%)				
	Faizabad	Bhubaneswar	Kalyani	Average	Rank	Faizabad	Bhubaneswar	Kalyani	Average	Rank
AFB-8	4.6	8.1	3.2	5.3	2	7.7	7.7	8.9	8.1	3
NDFB-936	3.4	7.2	2.3	4.3	5	8.7	7.5	6.0	7.4	5
APFB-09-1	6.5	7.4	2.8	5.6	1	8.8	7.6	8.9	8.4	1
AVKB-19 (NC)	4.2	6.7	2.8	4.6	4	7.9	7.5	9.2	8.2	2
Giant Bajra (NC)	3.7	7.8	2.2	4.6	4	7.6	7.6	7.6	7.6	4
Raj Bajra Chari-2 (NC)	5.7	5.1	4.0	4.9	3	8.1	7.2	9.4	8.2	2
Mean	**4.7**	**7.1**	**2.9**	**4.9**		**8.1**	**7.5**	**8.3**	**8.0**	

Table 4.4 AVTPM-1 First Advanced Varietal Trial in Forage Pearl millet : Plant Height (cm) and Leaf stem ratio

Entries	Plant Height (cm)							Leaf stem ratio							
	Faiza.	Bhuban.	Ranchi	Kalyani	Jorhat	Avera.	Rank	Faiza.	Pusa	Bhuban.	Ranchi	Kalyani	Jorhat	Avera.	Rank
AFB-8	190.5	319.3	199.6	212.7	75.7	199.5	1	0.67	0.99	1.30	0.30	0.45	0.97	0.78	2
NDFB-936	195.6	287.3	196.5	214.8	42.8	187.4	6	0.70	0.98	1.16	0.29	0.43	0.92	0.75	4
APFB-09-1	195.2	307.6	180.3	210.9	65.3	191.8	3	0.74	0.99	1.08	0.37	0.45	0.81	0.74	5
AVKB-19 (NC)	187.5	274.6	194.4	205.2	79.4	188.2	4	0.69	0.98	1.00	0.27	0.38	1.23	0.76	3
Giant Bajra (NC)	180.5	304.2	197.4	215.2	62.9	192.0	2	0.68	1.01	1.21	0.47	0.50	0.97	0.81	1
Raj Bajra Chari-2 (NC)	199.8	271.4	203.3	214.9	51.0	188.1	5	0.72	0.99	0.90	0.30	0.50	0.94	0.72	6
Mean	**191.5**	**294.0**	**195.3**	**212.3**	**62.8**	**191.2**		**0.70**	**0.99**	**1.11**	**0.33**	**0.45**	**0.98**	**0.76**	

5. IVTC: Initial Varietal Trial in Forage Cowpea

In forage cowpea, five entries along with two national checks namely Bundel Lobia-1 and UPC-5286 and three zonal checks *viz*; UPC-622, BL-2 and UPC-9202 for respective zones were evaluated in initial varietal trial at 23 locations across the five zones. For green forage yield (q/ha), entries MFC-09-9 (6.4%), UPC-1301 (3.2%) and SKFC-1 (1.8%) in Hill zone; TNFC-0926 (6.7%), and UPC-1301 (6.5%) in North East zone; MFC-09-9 (1.4%) in Central zone and TNFC-0926 (12.7%) and MFC-09-9 (3.3%) in South zone exhibited superiority over best national/zonal check. At national level, UPC-1301 with 1.3 per cent superiority was ranked best performer.

For dry matter yield (q/ha), entries MFC-09-9 (7.5%) and UPC-1301 (2.2%) in Hill zone; UPC-1301 (0.4%) in North West zone; entries TNFC-0926 (8.2%) and UPC-1301 (7.8%) in North East zone and entries TNFC-0926 (16.2%) and MFC-09-9 (4.7%) in South zone exhibited their superiority with respect to best check. At national level, entry UPC-1301 (3.9%) proved superiority over best check UPC-5286.

For fodder production potential (q/ha/day), entry TNFC-0926 for green forage as well as for dry matter yield registered superiority. For evaluation against quality parameters, UPC-1301 (7.6 q/ha) for crude protein yield and HFC-11-3 (17.2%) for crude protein content was adjudged best performer. Entry UPC-1301 (127.9 cm) for plant height and check variety UPC-5286 (0.87) for leafiness maintained superiority. For other quality parameters, entry HFC-11-3 for ADF (%) and NDF (%) and TNFC-0926 and UPC-5286 for IVDMD (%) registered their superiority. **(Table Reference: 5.1 to 5.9)**

6. AVTC-1: First Advanced Varietal Trial in Forage Cowpea

In forage cowpea, two entries namely MFC-09-5 and TNFC-0924 along with national checks namely BL-1 and UPC-5286 and two zonal checks *i.e.* UPC-622 and UPC-9202 for respective zones were evaluated in first advanced varietal trial at 12 locations across North East and south zone. For green forage yield (q/ha), entry TNFC-0924 (0.55%) in South zone registered superiority whereas none of the entries established their superiority in North East zone. At national level, check Bundel Lobia-1 maintained superiority. Similarly for dry matter yield (q/ha), entry TNFC-0924 proved its superiority in North East zone and South zone as well as at national level.

For fodder production potential (q/ha/day), again TNFC-0924 ranked first both for green forage as well as dry matter production potential. For quality parameters, TNFC-0924 was best performer both for crude protein yield (q/ha) as well as crude protein content (%). For plant height, TNFC-0924 (121.3 cm) and for leafiness, MFC-09-5 (0.75) established superiority. **(Table Reference: 6.1 to 6.6)**

Table 5.1 IVTC-Initial Varietal Trial in Forage Cowpea: Green Forage Yield(q/ha)

Entries	Hill Zone					North West Zone							North East Zone							
	Palam.	Srina.	Avera.	Rank	Super%	Ludhi.	Hisar	Bikan.	Udaip.	Jalore	Avera.	Rank	Faiza.	Kalya.	Bhuba.	Jorhat	Ranchi*	Avera.	Rank	Super%
TNFC-0926	90.0	115.3	102.7	8		434.1	141.4	196.7	307.9	160.0	248.0	4	189.3	434.8	325.0	247.3	187.5	299.1	1	6.7
MFC-09-9	133.6	143.7	138.7	1	6.4	329.9	91.3	183.1	400.5	176.0	236.2	5	87.6	395.5	279.1	188.5	152.8	237.7	7	
SKFC-1	103.1	162.3	132.7	3	1.8	107.7	94.2	171.0	152.8	148.3	134.8	8	103.6	379.5	282.9	156.3	180.6	230.6	8	
HFC-11-3	90.0	132.8	111.4	6		90.3	168.6	285.3	263.9	174.7	196.6	7	201.6	375.7	302.0	200.0	97.2	269.8	4	
UPC-1301	160.6	108.7	134.7	2	3.2	473.9	141.6	262.8	365.8	176.0	284.0	2	209.6	367.0	362.4	255.4	125.0	298.6	2	6.5
Bundel Lobia-1 (NC)	91.2	128.3	109.8	7		305.6	108.6	196.0	291.7	158.3	212.0	6	125.0	394.8	295.8	231.9	166.7	261.9	5	
UPC-5286 (NC)	124.1	136.7	130.4	4		468.9	147.8	293.0	386.6	175.0	294.3	1	136.6	394.8	314.5	182.5	201.4	257.1	6	
Bundel Lobia-2 ZC (NWZ)						347.3	223.3	177.1	354.2	188.3	258.0	3								
UPC-9202 ZC (CZ-SZ)																				
UPC-622 ZC (NEZ-HZ)	115.4	111.3	113.4	5									202.8	391.0	339.5	188.0	263.9	280.3	3	
Mean	**113.5**	**129.9**	**121.7**			**319.7**	**139.6**	**220.6**	**315.4**	**169.6**	**233.0**		**157.0**	**391.6**	**312.7**	**206.2**	**171.9**	**266.9**		
CD at 5%	27.4	3.6				38.2	39.8	30.0	69.0	23.4			35.5	29.4	2.5	6.9	65.0			
CV%	16.4	1.6				8.4	19.3	9.3	12.5	7.7			15.4	5.1	9.6	9.7	25.6			

Entries	Central Zone								South Zone									All India		
	Anand	Jhansi	Rahuri	Urulik.	Kanp.	Avera.	Rank	Super%	Coimb.	Vellay.	Mand.	Hyder.	Dharw.	Karaik.	Avera.	Rank	Super%	Avera.	Rank	Super%
TNFC-0926	459.0	166.7	281.2	390.6	232.6	306.0	5		354.2	293.3	205.4	294.0	347.2	141.9	272.7	1	12.7	264.0	3	
MFC-09-9	441.0	168.5	286.9	473.9	392.4	352.6	1	1.4	298.6	315.0	217.6	291.7	246.5	129.3	249.8	2	3.3	257.7	4	
SKFC-1	306.0	115.1	144.2	260.4	197.9	204.7	8		229.2	261.7	105.0	208.8	267.4		214.4	7		188.4	7	
HFC-11-3	428.0	158.0	109.4	406.2	229.2	266.1	7		227.4	280.0	75.4	143.5	177.1	100.9	167.4	8		210.0	6	
UPC-1301	406.0	195.3	306.7	423.6	361.1	338.5	3		257.6	258.3	213.3	231.0	263.9	123.9	224.7	5		269.3	1	1.3
Bundel Lobia-1 (NC)	408.0	196.2	220.3	402.8	243.1	294.1	6		215.3	248.3	160.4	202.3	277.8	198.0	217.0	6		231.8	5	
UPC-5286 (NC)	470.0	159.7	306.7	423.6	378.5	347.7	2		288.2	305.0	138.5	271.3	208.3	140.3	225.3	4		265.9	2	
Bundel Lobia-2 ZC (NWZ)																				
UPC-9202 ZC (CZ-SZ)	425.0	188.5	274.4	434.0	288.2	322.0	4		277.8	271.7	165.1	266.2	284.7	186.0	241.9	3				
UPC-622 ZC (NEZ-HZ)																				
Mean	**417.9**	**168.5**	**241.2**	**401.9**	**290.4**	**304.0**			**268.5**	**279.2**	**160.1**	**238.6**	**259.1**	**145.7**	**226.6**			**243.8**		
CD at 5%	28.3	2.6	17.8	20.7	44.8				32.9	27.3	30.8	14.6	24.6	17.6						
CV%	4.6	10.6	5.0	18.8	10.5				8.3	3.2	11.0	3.5	6.5	6.8						

***not included in zonal and all india average due to cv>20**

Table 5.2 IVTC-Initial varietal trial in Forage Cowpea: Dry matter Yield(q/ha)

Entries	Hill Zone					North West Zone						North East Zone							
	Palam.	Srina.	Avera.	Rank	Super%	Ludhi.	Hisar	Bikan.	Avera.	Rank	Super%	Faiza.	Kalya.	Bhuba.	Jorhat	Ranchi*	Avera.	Rank	Super%
TNFC-0926	16.3	16.8	16.6	8		65.1	21.2	30.1	38.8	4		42.2	48.9	71.6	49.5	25.8	53.0	1	8.2
MFC-09-9	25.2	23.8	24.5	1	7.5	58.1	13.8	28.4	33.4	6		14.7	45.0	61.5	37.5	18.3	39.7	7	
SKFC-1	19.2	26.1	22.7	4		16.7	13.4	27.8	19.3	8		23.0	45.1	63.8	24.7	25.3	39.1	8	
HFC-11-3	17.1	22.0	19.6	5		13.8	26.1	46.2	28.7	7		44.1	42.7	66.0	34.3	13.9	46.8	4	
UPC-1301	30.8	15.8	23.3	2	2.2	83.5	20.6	42.5	48.9	1	0.4	47.2	44.0	79.2	40.8	16.4	52.8	2	7.8
Bundel Lobia-1 (NC)	16.8	21.0	18.9	6		52.7	17.6	30.4	33.6	5		27.3	45.4	65.3	43.9	18.9	45.4	5	
UPC-5286 (NC)	22.6	23.0	22.8	3		80.7	23.3	42.1	48.7	2		27.6	43.4	70.6	34.4	23.6	44.0	6	
Bundel Lobia-2 ZC (NWZ)						60.9	34.4	27.0	40.8	3									
UPC-9202 ZC (CZ-SZ)																			
UPC-622 ZC (NEZ-HZ)	21.0	15.7	18.4	7								42.9	44.4	76.2	32.4	36.9	49.0	3	
Mean	**21.1**	**20.5**	**20.8**			**53.9**	**21.3**	**34.3**	**36.5**			**33.6**	**44.9**	**69.3**	**37.2**	**22.4**	**46.2**		
CD at 5%	5.4	1.1				6.1	5.9	6.0				6.9	NS	0.5	2.8	8.9			
CV%	17.8	3.2				8.0	18.8	11.8				13.9	5.5	9.2	9.4	26.7			

Entries	Central Zone							South Zone									All India		
	Anand	Jhansi	Rahuri	Urulika.	Kan.	Avera.	Rank	Coimb.	Vellay.	Mand.	Hyder.	Dharw.	Karaik.	Avera.	Rank	Super%	Avera.	Rank	Super%
TNFC-0926	68.4	37.7	37.6	55.0	54.5	50.6	5	58.5	48.1	32.6	32.0	76.8	18.9	44.5	1	16.2	44.1	2	
MFC-09-9	58.1	38.2	33.9	69.3	92.7	58.5	3	52.6	51.6	38.7	32.2	49.2	16.1	40.1	2	4.7	42.0	3	
SKFC-1	32.2	24.8	22.5	39.4	47.9	33.4	8	43.6	42.9	17.3	32.4	54.6		38.2	4		32.5	6	
HFC-11-3	61.7	35.5	15.4	60.8	53.8	45.4	7	37.0	45.9	12.1	16.7	36.5	12.8	26.8	8		35.0	5	
UPC-1301	58.5	44.1	48.4	63.5	84.4	59.8	2	43.0	42.3	33.0	24.2	54.4	15.0	35.3	7		45.8	1	3.9
Bundel Lobia-1 (NC)	51.0	45.8	29.7	57.5	57.6	48.3	6	36.8	40.7	26.0	24.1	58.3	30.8	36.1	5		38.9	4	
UPC-5286 (NC)	65.7	35.4	47.9	63.0	89.6	60.3	1	52.9	50.0	17.8	28.5	43.3	20.1	35.4	6		41.1	2	
Bundel Lobia-2 ZC (NWZ)																			
UPC-9202 ZC (CZ-SZ)	59.1	42.0	32.8	64.3	68.1	53.2	4	47.5	44.5	26.0	29.8	54.3	28.0	38.3	3				
UPC-622 ZC (NEZ-HZ)																			
Mean	**56.8**	**37.9**	**33.5**	**59.1**	**68.6**	**51.2**		**46.5**	**45.8**	**25.4**	**27.5**	**53.4**	**20.2**	**36.8**			**40.6**		
CD at 5%	3.8	6.1	2.4	5.6	10.7			8.5	4.5	6.2	4.9	6.2	5.2						
CV%	4.6	10.9	4.9	16.0	10.6			12.0	3.2	13.9	10.3	7.9	14.4						

***not included in zonal and all india average due to cv>20**

Table 5.3 IVTC-Initial Varietal Trial in Forage Cowpea: Green Forage Yield(q/ha/day)

Entries	Palam.	Srina.	Ludhi.	Hisar	Bikan.	Faiza.	Ranchi	Kalya.	Bhuba.	Jorhat	Anand	Jhansi	Rahuri	Urulik.	Kanp.	Coimb.	Mandya	Hyder.	Dharwad	Avera.	Rank
TNFC-0926	1.17	1.16	9.12	1.68	3.39	2.91	2.93	5.88	3.92	3.99	7.06	2.96	5.41	7.51	4.01	5.45	4.53	5.07	5.79	4.42	1
MFC-09-9	1.74	1.33	5.76	1.09	3.16	1.41	2.12	5.20	3.88	2.90	6.78	2.81	5.22	9.11	6.04	4.98	4.60	4.47	4.11	4.04	3
SKFC-1	1.34	1.62	2.55	1.12	2.95	1.69	2.66	4.47	7.86	3.53	6.65	2.72	2.94	5.01	5.21	5.09	2.34	5.81	4.46	3.69	6
HFC-11-3	1.17	1.23	2.05	2.01	4.92	3.01	1.45	6.48	4.14	3.23	7.13	2.77	2.33	7.81	4.88	4.55	1.69	2.27	2.95	3.48	7
UPC-1301	2.09	1.05	6.70	1.69	4.53	3.08	1.92	4.77	4.83	3.81	6.25	3.23	5.58	8.15	4.46	4.29	4.53	5.04	4.40	4.23	2
Bundel Lobia-1 (NC)	1.20	1.19	6.34	1.29	3.38	1.89	2.65	6.17	4.23	3.74	7.42	3.15	4.16	7.75	4.12	4.48	3.73	4.41	4.63	4.00	4
UPC-5286 (NC)	1.61	1.30	6.60	1.76	5.05	2.27	2.92	5.13	3.66	2.81	6.27	2.56	4.20	8.15	5.57	4.43	2.97	4.63	3.47	3.97	5
Bundel Lobia-2 ZC (NWZ)			6.12	2.66	3.05																
UPC-9202 ZC (CZ-SZ)											5.67	3.40	3.92	8.35	3.56	4.41	3.82	5.47	4.75		
UPC-622 ZC (NEZ-HZ)	1.50	1.08				2.94	3.67	5.28	4.24	2.89											
Mean	**1.48**	**1.25**	**5.66**	**1.66**	**3.80**	**2.40**	**2.54**	**5.42**	**4.60**	**3.36**	**6.65**	**2.95**	**4.22**	**7.73**	**4.73**	**4.71**	**3.53**	**4.65**	**4.32**	**3.97**	

Table 5.4 IVTC-Initial Varietal Trial in Forage Cowpea: Dry Matter Yield(q/ha/day)

Entries	Srina.	Ludhi.	Hisar	Bikan.	Faiza.	Ranchi	Kalya.	Bhuba.	Jorhat	Anand	Jhansi	Rahuri	Urulik.	Kanpur	Coimb.	Hyder.	Dharw.	Karaik.	Avera.	Rank
TNFC-0926	0.17	1.40	0.25	0.52	0.65	0.40	0.66	0.86	0.80	1.05	0.67	0.72	1.06	0.94	0.90	0.55	1.28	0.38	0.74	1
MFC-09-9	0.22	1.00	0.16	0.49	0.24	0.25	0.59	0.85	0.58	0.89	0.64	0.62	1.33	1.43	0.88	0.49	0.82	0.24	0.65	5
SKFC-1	0.26	0.40	0.16	0.48	0.38	0.37	0.53	1.77	0.56	0.70	0.59	0.46	0.76	1.26	0.97	0.90	0.91		0.67	4
HFC-11-3	0.20	0.30	0.31	0.80	0.66	0.21	0.74	0.90	0.55	1.03	0.62	0.33	1.17	1.15	0.74	0.26	0.61	0.27	0.60	6
UPC-1301	0.15	1.20	0.24	0.73	0.70	0.25	0.57	1.06	0.61	0.90	0.73	0.88	1.22	1.04	0.72	0.53	0.91	0.28	0.71	2
Bundel Lobia-1 (NC)	0.19	1.10	0.21	0.52	0.41	0.30	0.71	0.93	0.71	0.93	0.74	0.56	1.11	0.98	0.77	0.53	0.97	0.62	0.68	3
UPC-5286 (NC)	0.22	1.10	0.28	0.73	0.46	0.34	0.56	0.82	0.53	0.88	0.57	0.66	1.21	1.32	0.81	0.49	0.72	0.31	0.67	4
Bundel Lobia-2 ZC (NWZ)		1.00	0.41	0.47																
UPC-9202 ZC (CZ-SZ)										0.79	0.76	0.47	1.24	0.84	0.75	0.61	0.90	0.51		
UPC-622 ZC (NEZ-HZ)	0.15				0.62	0.51	0.60	0.95	0.50											
Mean	**0.20**	**0.94**	**0.25**	**0.59**	**0.52**	**0.33**	**0.62**	**1.02**	**0.60**	**0.90**	**0.67**	**0.59**	**1.14**	**1.12**	**0.82**	**0.55**	**0.89**	**0.37**	**0.67**	

Table 5.5 IVTC-Initial Varietal Trial in Forage Cowpea: Crude Protein Yield (q/ha)

Entries	Palampur	Ludhiana	Faizabad	Bhuban.	Anand	Rahuri	Urulika.	Hisar	Coimba.	Karaikkal	Hyderabad	Average	Rank
TNFC-0926	3.0	11.4	7.0	10.6	9.2	6.7	8.8	3.9	10.5	3.5	5.4	7.3	3
MFC-09-9	4.2	9.2	2.5	9.0	7.0	4.4	11.6	2.4	10.1	3.6	3.6	6.2	4
SKFC-1	3.9	3.0	4.1	8.8	4.1	3.0	6.3	2.5	7.6		4.8	4.8	7
HFC-11-3	3.2	2.5	7.4	9.4	8.5	2.1	10.3	4.2	7.0	2.7	2.4	5.4	6
UPC-1301	5.8	14.0	8.8	12.0	7.1	6.8	10.4	3.8	7.3	2.7	4.3	7.6	1
Bundel Lobia-1 (NC)	3.0	8.4	4.3	9.9	6.3	5.0	9.1	3.4	6.5	6.5	3.7	6.0	5
UPC-5286 (NC)	4.3	14.3	4.6	9.6	8.9	6.8	10.5	4.2	11.3	3.5	4.6	7.5	2
Bundel Lobia-2 ZC (NWZ)		9.8						6.0					
UPC-9202 ZC (CZ-SZ)					8.0	5.6	10.9		9.4	4.5	4.6		
UPC-622 ZC (NEZ-HZ)	3.8		7.7	11.4									
Mean	**3.9**	**9.1**	**5.8**	**10.1**	**7.4**	**5.1**	**9.7**	**3.8**	**8.7**	**3.9**	**4.2**	**6.4**	

Table 5.6 IVTC-Initial Varietal Trial in Forage Cowpea: Crude Protein (%)

Entries	Palam.	Ludhi.	Faiza.	Bhuban.	Anand	Rahuri	Urulika.	Coimb.	Mandya	Hyder.	Karaik.	Hisar	Hyder.	Vellay.	Avera.	Rank
TNFC-0926	18.4	17.5	16.5	14.7	13.5	17.8	16.1	18.0	14.0	18.4	18.4	18.6	16.6	18.8	17.0	2
MFC-09-9	18.4	15.9	17.0	14.6	12.0	13.1	16.8	19.3	10.5	22.3	22.3	17.5	11.4	21.9	16.6	3
SKFC-1	20.1	17.8	17.9	13.8	12.7	13.5	16.1	17.5	14.0	14.9		18.4	14.9	19.3	16.3	4
HFC-11-3	18.6	18.0	16.8	14.4	13.8	13.8	16.9	18.8	15.8	21.0	21.0	16.2	14.4	21.4	17.2	1
UPC-1301	18.8	16.8	18.6	15.2	12.1	14.0	16.4	17.1	9.6	18.4	18.4	18.4	17.9	20.1	16.6	3
Bundel Lobia-1 (NC)	17.5	15.9	15.6	15.1	12.4	16.8	15.9	17.5	15.3	21.0	21.0	19.5	15.3	21.9	17.2	1
UPC-5286 (NC)	19.0	17.7	16.6	13.6	13.5	14.2	16.6	21.5	16.4	17.5	17.5	18.2	16.2	20.1	17.0	2
Bundel Lobia-2 ZC (NWZ)		16.1										17.5				
UPC-9202 ZC (CZ-SZ)					13.5	17.1	17.0	19.7	15.3	16.2	16.2		15.3	18.8		
UPC-622 ZC (NEZ-HZ)	18.2		17.8	15.0												
Mean	**18.6**	**17.0**	**17.1**	**14.6**	**12.9**	**15.0**	**16.5**	**18.7**	**13.9**	**19.3**	**19.3**	**18.0**	**15.3**	**20.3**	**16.8**	

Table 5.7 IVTC-Initial Varietal Trial in Forae Cowpea: Plant Height (cm)

Entries	Palampur	Srinagar	Hisar	Bikaner	Udaipur	Faizabad	Ranchi	Kalyani	Bhuban.	Jorhat	Anand
TNFC-0926	90.5	119.7	133.8	153.0	98.8	165.6	102.4	103.6	249.2	137.3	144.4
MFC-09-9	94.2	123.7	150.7	60.0	111.5	115.4	97.9	98.6	209.1	122.9	147.0
SKFC-1	97.7	135.0	135.8	55.0	64.3	156.7	102.9	101.1	214.2	116.6	127.2
HFC-11-3	95.2	105.0	141.8	65.0	93.0	176.5	87.3	105.3	238.6	128.9	144.1
UPC-1301	92.7	115.3	161.6	90.0	108.1	180.5	96.4	103.1	265.1	146.3	143.1
Bundel Lobia-1 (NC)	82.7	122.7	161.2	132.0	91.6	167.8	100.3	102.1	229.2	152.3	132.4
UPC-5286 (NC)	85.5	103.7	145.4	80.0	100.7	164.8	100.1	105.7	244.1	120.2	141.2
Bundel Lobia-2 ZC (NWZ)			161.8	158.0	102.0						
UPC-9202 ZC (CZ-SZ)											138.7
UPC-622 ZC (NEZ-HZ)	87.0	104.0				150.6	104.1	106.1	257.9	124.5	
Mean	**90.7**	**116.1**	**149.0**	**99.1**	**96.3**	**159.7**	**98.9**	**103.2**	**238.4**	**131.1**	**139.8**

Entries	Jhansi	Rahuri	Kanpur	Urulika.	Ludhiana	Coimba.	Vellayani	Mandya	Hyderabad	Karaikkal	Average	Rank
TNFC-0926	93.4	63.9	142.9	191.2	78.3	76.1	101.7	60.1	125.3	90.7	120.1	3
MFC-09-9	76.2	76.6	132.0	198.1	90.3	87.3	101.3	59.9	109.4	92.7	112.1	5
SKFC-1	98.1	113.0	67.2	160.8	62.2	76.7	105.3	46.7	123.8		108.0	6
HFC-11-3	80.5	89.3	62.2	172.0	71.5	75.5	117.7	47.9	90.1	61.0	107.1	7
UPC-1301	81.3	133.8	140.1	199.2	137.6	97.0	120.0	58.3	106.7	110.7	127.9	1
Bundel Lobia-1 (NC)	116.6	99.9	130.5	159.7	71.4	61.8	110.3	66.5	113.3	82.0	118.4	4
UPC-5286 (NC)	107.0	148.4	156.0	196.8	135.7	90.0	105.3	53.3	107.7	86.0	122.7	2
Bundel Lobia-2 ZC (NWZ)					81.3							
UPC-9202 ZC (CZ-SZ)	96.7	86.7	123.9	173.3		86.0	123.3	59.3	117.7	96.7		
UPC-622 ZC (NEZ-HZ)												
Mean	**93.7**	**101.4**	**119.4**	**181.4**	**91.0**	**81.3**	**110.6**	**56.5**	**111.8**	**88.5**	**117.6**	

Table 5.8 IVTC-Initial Varietal Trial in Forage Cowpea: Leaf Stem Rati

Entries	Palam.	Ludhi.	Hisar	Bikan.	Faiza.	Ranchi	Kalya.	Bhuba.	Jorhat	Jhansi	Rahuri	Urulika.	Kanp.	Coimb.	Vellay.	Mandya	Hyder.	Karaik.	Avera.	Rank
TNFC-0926	0.57	1.49	0.65	0.71	0.61	0.77	0.83	1.09	0.86	0.85	0.87	1.17	0.64	0.34	0.77	0.71	0.62	0.43	0.78	3
MFC-09-9	0.49	1.05	0.69	0.93	0.68	0.76	0.69	0.89	1.06	0.97	0.75	1.06	0.55	0.36	0.77	0.78	0.71	0.45	0.76	5
SKFC-1	0.53	1.05	0.62	0.98	0.65	0.86	0.83	0.94	1.09	1.02	0.73	0.58	0.83	0.33	0.78	0.71	0.62		0.77	4
HFC-11-3	0.62	0.90	0.66	1.05	0.70	0.79	0.75	1.04	0.94	0.96	0.87	0.97	0.85	0.37	0.73	0.55	0.93	0.36	0.78	3
UPC-1301	0.58	1.65	0.67	0.95	0.72	0.88	0.92	1.24	1.01	1.00	0.66	1.34	0.57	0.35	0.71	0.74	0.78	0.49	0.85	2
Bundel Lobia-1 (NC)	0.53	0.73	0.68	0.56	0.67	0.83	0.83	0.98	0.82	0.77	0.76	0.95	0.64	0.37	0.85	0.61	0.57	0.52	0.70	6
UPC-5286 (NC)	0.52	1.84	0.67	1.03	0.75	0.77	0.83	1.07	1.52	1.18	0.66	1.03	0.72	0.36	0.87	0.50	0.93	0.40	0.87	1
Bundel Lobia-2 ZC (NWZ)		1.66	0.70	0.77																
UPC-9202 ZC (CZ-SZ)										0.83	0.76	0.75	0.75	0.34	0.76	0.62	0.76	0.50		
UPC-622 ZC (NEZ-HZ)	0.59				0.73	0.88	0.77	1.19	0.94											
Mean	**0.55**	**1.30**	**0.67**	**0.87**	**0.69**	**0.82**	**0.81**	**1.06**	**1.03**	**0.95**	**0.76**	**0.98**	**0.69**	**0.35**	**0.78**	**0.65**	**0.74**	**0.45**	**0.79**	

Table 5.9 IVTC-Initial Varietal Trial in Forage Cowpea: ADF (%) , NDF (%)& IVDMD (%

Entries	ADF (%)				NDF (%)					IVDMD (%)				
	Ludhiana	Rahuri	Average	Rank	Ludhiana	Anand	Rahuri	Average	Rank	Ludhiana	Rahuri	Hisar	Average	Rank
TNFC-0926	33.8	42.5	38.1	2	47.5	54.0	55.2	52.2	2	77.0	55.2	75.0	69.1	1
MFC-09-9	37.0	47.4	42.2	7	50.3	66.0	54.9	57.1	6	70.8	54.9	74.4	66.7	3
SKFC-1	33.9	46.4	40.2	4	46.1	60.0	52.3	52.8	3	77.0	52.3	70.4	66.6	4
HFC-11-3	27.4	42.8	35.1	1	43.5	53.0	50.1	48.9	1	78.6	50.1	72.6	67.1	2
UPC-1301	34.5	45.2	39.8	3	47.8	60.0	53.5	53.8	5	74.0	53.5	72.6	66.7	3
Bundel Lobia-1 (NC)	37.0	44.4	40.7	5	50.3	56.0	52.7	53.0	4	75.2	52.7	71.4	66.4	5
UPC-5286 (NC)	33.4	48.3	40.8	6	47.2	55.0	56.2	52.8	3	76.2	56.2	74.8	69.1	1
Bundel Lobia-2 ZC (NWZ)	36.6				48.3					76.2		68.6		
UPC-9202 ZC (CZ-SZ)		38.7				54.0	46.0				46.0			
UPC-622 ZC (NEZ-HZ)														
Mean	**34.2**	**44.4**	**39.6**		**47.6**	**57.3**	**52.6**	**52.9**		**75.6**	**52.6**	**72.5**	**67.4**	

Table 6.1 : AVTC-1 : First Advanced Varietal Trial in Forage Cowpea : Green Forage Yield (q/ha)

Entries	North East Zone								South Zone									All India	
	Faiza.	Ranchi	Bhuba.	Jorhat	Pusa	Kalya.	Avera.	Rank	Coimb.	Vellay.	Mand.	Hyder.	Karaik.	Dharw.	Avera.	Rank	Super%	Avera.	Rank
MFC-09-5	166.1	83.3	185.5	206.8	388.0	288.2	219.7	3	121.0	270.0	154.8	130.6	161.0	164.6	167.0	4		193.3	3
TNFC-0924	167.0	96.4	255.3	238.8	266.0	293.0	219.4	4	194.4	256.3	95.4	189.5	129.6	218.8	180.7	1	0.55	200.0	1
Bundel Lobia-1 (NC)	136.3	101.6	225.6	232.2	366.0	299.5	226.9	1	119.8	275.0	114.4	192.2	135.8	202.1	173.2	3		200.0	1
UPC-5286 (NC)	124.7	132.8	208.9	217.7	344.0	310.1	223.0	2	105.8	305.0	98.6	142.7	175.8	154.2	163.7	5		193.4	2
UPC-622 ZC (NEZ)	156.9	104.2	231.9	196.4	333.0	272.4	215.8	5											
UPC-9202 ZC (SZ)									132.9	261.3	132.9	186.4	187.8	177.1	179.7	2			
Mean	**150.2**	**103.6**	**221.4**	**218.4**	**339.4**	**292.6**	**220.9**		**134.8**	**273.5**	**119.2**	**168.3**	**158.0**	**183.3**	**172.9**			**196.7**	
CD at 5%	33.7	27.9	20.2	5.1	29.5	16.5			16.4	27.2	13.2	23.5	14.1	29.0					
CV%	14.6	17.3	5.9	6.9	10.2	3.6			7.9	3.2	7.4	9.1	5.8	10.3					

Table 6.2 : AVTC-1 : First Advanced Varietal Trial in Forage Cowpea : Dry Matter Yield (q/ha

Entries	North East Zone									South Zone										All India		
	Faiza.	Ranchi	Kalya.	Bhuba.	Jorhat	Pusa	Avera	Rank	Super%	Coimb.	Vellay.	Mand.	Hyder.	Karaik.	Dharw.	Avera	Rank	Super%	Avera	Rank	Super%
MFC-09-5	31.9	11.3	32.0	41.1	38.5	84.0	39.8	3		16.6	44.3	24.3	15.1	22.7	33.5	26.1	5		32.9	4	
TNFC-0924	40.4	14.6	32.9	56.2	43.0	59.0	41.0	1	0.74	28.1	42.0	16.6	22.6	16.4	48.5	29.0	1	0.6	35.0	1	3.9
Bundel Lobia-1 (NC)	29.4	14.4	34.4	49.7	37.1	79.0	40.7	2		16.4	45.1	19.0	23.1	17.2	39.2	26.7	3		33.7	2	
UPC-5286 (NC)	24.4	20.7	34.1	46.6	37.1	76.0	39.8	3		15.2	50.0	15.7	15.0	28.6	32.7	26.2	4		33.0	3	
UPC-622 ZC (NEZ)	29.1	15.7	31.7	51.1	35.8	74.0	39.6	4													
UPC-9202 ZC (SZ)										19.3	42.8	22.1	21.2	29.5	38.1	28.8	2				
Mean	**31.0**	**15.3**	**33.0**	**48.9**	**38.3**	**74.4**	**40.2**			**19.1**	**44.8**	**19.5**	**19.4**	**22.8**	**38.4**	**27.4**			**33.7**		
CD at 5%	6.1	4.3	2.0	4.4	2.6	6.3				2.8	4.5	3.3	4.1	3.4	6.3						
CV%	12.8	17.9	4.0	5.8	11.6	8.7				9.5	3.2	11.2	13.6	9.5	10.7						

Table 6.3 : AVTC-1 : First Advanced Varietal Trial in Forage Cowpea : Green Forage Yield (q/ha/day)

Entries	Faizabad	Ranchi	Bhubaneswar	Jorhat	Pusa	Kalyani	Coimbatore	Mandya	Hyderabad	Dharwad	Average	Rank
MFC-09-5	2.27	1.67	4.31	3.21	6.68	3.74	2.02	5.12	2.23	2.74	3.40	3
TNFC-0924	2.28	1.58	5.32	3.72	4.66	3.81	3.53	3.51	3.21	3.65	3.53	1
Bundel Lobia-1 (NC)	1.95	1.72	4.34	3.59	6.31	3.89	2.40	4.03	3.20	3.37	3.48	2
UPC-5286 (NC)	1.83	2.77	5.10	3.38	6.14	4.03	1.63	3.08	2.50	2.57	3.30	4
UPC-622 ZC (NEZ)	2.21	1.80	5.39	3.06	5.84	3.54						
UPC-9202 ZC (SZ)							2.04	4.43	3.36	2.95		
Mean	**2.11**	**1.91**	**4.89**	**3.39**	**5.93**	**3.80**	**2.32**	**4.03**	**2.90**	**3.06**	**3.43**	

Table 6.4 : AVTC-1 : First Advanced Varietal Trial in Forage Cowpea : Dry Matter Yield (q/ha/day) and Crude Protein Yield (q/ha)

Entries	Dry matter Yield (q/ha/day)												Crude protein Yield (q/ha)							
	Faiza.	Ranchi	Bhuban.	Jorhat	Pusa	Kalya.	Coimb.	Hydera.	Karaik.	Dharw.	Avera.	Rank	Faiza.	Kalya.	Bhuban.	Coimb.	Karaik.	Hydera.	Avera.	Rank
MFC-09-5	0.43	0.23	0.95	0.60	1.44	0.42	0.28	0.26	0.43	0.56	0.56	4	5.7	4.6	6.2	2.5	3.6	2.6	4.2	3
TNFC-0924	0.55	0.24	1.17	0.67	1.04	0.43	0.51	0.38	0.31	0.81	0.61	1	7.2	4.5	8.2	4.4	3.2	4.1	5.3	1
Bundel Lobia-1 (NC)	0.42	0.24	0.96	0.57	1.36	0.45	0.33	0.38	0.32	0.65	0.57	3	4.9	3.7	7.4	2.5	3.4	4.1	4.3	2
UPC-5286 (NC)	0.36	0.43	1.14	0.57	1.36	0.44	0.23	0.26	0.49	0.55	0.58	2	4.2	4.4	7.1	2.5	4.6	2.8	4.3	2
UPC-622 ZC (NEZ)	0.41	0.27	1.19	0.56	1.30	0.41							5.2	2.7	7.6					
UPC-9202 ZC (SZ)							0.30	0.38	0.50	0.63						3.3	5.0	4.0		
Mean	**0.43**	**0.28**	**1.08**	**0.59**	**1.30**	**0.43**	**0.33**	**0.33**	**0.41**	**0.64**	**0.58**		5.4	4.0	7.3	3.1	4.0	3.5	4.5	

Table 6.5 : AVTC-1 : First Advanced Varietal Trial in Forage Cowpea : Crude Protein (%) & Plant Height (cm)

Entries	Crude Protein (%)										Plant Height (cm)											
	Faiza.	Kalya.	Bhuba.	Coimb.	Mand.	Hyder.	Karaik.	Vellay.	Avera.	Rank	Faiza.	Ranchi	Bhuba.	Jorhat	Kalya.	Coimb.	Vellaya.	Mand.	Hyder.	Karaik.	Avera.	Ra.
MFC-09-5	18.0	14.5	15.2	15.3	16.4	17.5	15.8	22.8	16.9	3	133.5	93.3	196.6	161.5	91.4	97.7	117.5	59.0	63.5	82.8	109.7	4
TNFC-0924	17.8	13.8	14.6	15.8	15.8	18.0	19.7	25.4	17.6	1	158.7	91.3	234.3	142.3	99.7	86.3	137.3	56.9	123.8	82.5	121.3	1
Bundel Lobia-1 (NC)	16.5	10.8	14.9	15.5	15.1	18.0	19.7	25.4	17.0	2	148.2	99.5	214.2	178.1	94.9	66.2	130.3	57.6	100.3	69.8	115.9	2
UPC-5286 (NC)	17.1	12.9	15.1	16.6	15.3	18.4	16.2	19.7	16.4	4	145.8	90.5	207.1	115.6	104.8	79.2	132.5	55.8	103.8	97.0	113.2	3
UPC-622 ZC (NEZ)	17.8	8.7	14.8								135.8	94.6	227.9	144.1	93.0							
UPC-9202 ZC (SZ)				17.3	18.4	18.8	17.1	22.3								86.5	131.5	51.5	103.7	115.0		
Mean	**17.4**	**12.1**	**14.9**	**16.1**	**16.2**	**18.1**	**17.7**	**23.1**	**17**		**144.4**	**93.8**	**216.0**	**148.3**	**96.8**	**83.2**	**129.8**	**56.1**	**99.0**	**89.4**	**115.0**	

Table 6.6 : AVTC-1 : First Advanced Varietal Trial in Forage Cowpea : Leaf Stem Ratio

Entries	Faizabad	Ranchi	Bhuban.	Jorhat	Pusa	Kalyani	Coimba.	Vellayani	Mandya	Hyderabad	Karaikkal	Average	Rank
MFC-09-5	0.73	0.82	0.79	0.90	0.97	0.83	0.38	0.81	0.58	0.93	0.51	0.75	1
TNFC-0924	0.75	0.56	1.08	0.81	0.95	0.77	0.40	0.65	0.52	0.80	0.47	0.71	2
Bundel Lobia-1 (NC)	0.65	0.86	0.94	0.88	0.97	0.71	0.40	0.69	0.41	0.65	0.48	0.69	3
UPC-5286 (NC)	0.71	0.86	0.89	0.91	0.96	0.83	0.40	0.78	0.41	0.97	0.49	0.75	1
UPC-622 ZC (NEZ)	0.70	0.92	1.02	0.89	0.96	0.92							
UPC-9202 ZC (SZ)							0.40	0.73	0.44	0.84	0.53		
Mean	**0.71**	**0.80**	**0.94**	**0.88**	**0.96**	**0.81**	**0.40**	**0.73**	**0.47**	**0.84**	**0.50**	**0.72**	

7. IVT (Rice Bean): Initial Varietal Trial in Rice Bean

An initial varietal trial in forage rice bean with four entries namely BFRB-17, JRBJ-06-3, JRB-19 and JRB-18 along with three national checks *i.e*. RBL-6, Bidhan-1 and Bidhan-2 was conducted at 9 locations across the country. For green forage yield (q/ha), national check Bidhan-2 maintained its superiority. For dry matter yield (q/ha), entry BFRB-17 (4.0%) established superiority over best national check. For fodder production potential (q/ha/day), check variety RBL-6 ranked first both for green forage and dry matter production potential.

For plant height, entry JRB-18 (153.0 cm) ranked first whereas for leaf stem ratio, entry BFRB-17 (0.82) established its superiority.

For evaluation against quality parameters, entry JRBJ-06-3 for crude protein yield (q/ha) and check RBL-6 for crude protein content (%) registered superiority. **(Table Reference: 7.1 to 7.6)**

Table 7.1 IVT (R.bean) : Initial Varietal Trial in Rice bean : Green Forage Yield (q/ha)

Entries	Kalyani	Ranchi	Pusa	Jorhat	Imphal	Jabalpur	Raipur	Palghar	Bhubaneswar	Average	Rank
BFRB-17	295.4	638.9	499.0	274.0	231.2	133.3	427.8	279.9	355.2	348.3	2
JRBJ-06-3	286.6	536.9	466.0	240.2	171.1	337.4	474.7	245.7	255.2	334.9	4
JRB-19	263.0	601.9	488.0	305.9	112.7	293.7	415.9	271.4	293.7	338.5	3
JRB-18	255.1	398.1	499.0	302.4	275.1	216.6	407.4	259.3	284.3	321.9	5
RBL-6 (NC)	288.4	305.6	511.0	261.3	146.7	158.3	429.3	288.6	244.8	292.7	7
K-1(Bidhan-1) (NC)	275.9	536.9	477.0	228.3	173.4	108.2	451.7	254.4	238.5	304.9	6
Bidhan-2 (NC)	292.9	564.7	544.0	215.3	318.4	264.5	396.7	261.7	279.1	348.6	1
Mean	**279.6**	**511.9**	**497.7**	**261.1**	**204.1**	**216.0**	**429.1**	**265.9**	**278.7**	**327.1**	
CD at 5%	14.2	85.0	37.4	8.4	13.5	68.0	50.9	30.3	29.4		
CV%	2.8	9.2	10.8	11.1	3.7	14.1	6.6	6.8	5.9		

Table 7.2 IVT (R.bean) : Initial Varietal Trial in Rice bean : Dry Matter Yield (q/ha)

Entries	Kalyani	Ranchi	Pusa	Jorhat	Imphal	Jabalpur	Raipur	Palghar	Bhubaneswar	Average	Rank	Superi%
BFRB-17	45.3	207.5	113.0	45.3	41.6	42.2	79.5	53.1	78.1	78.4	1	4.0
JRBJ-06-3	41.1	193.6	105.0	44.8	29.8	63.5	88.9	48.8	53.0	74.3	3	
JRB-19	39.5	192.2	108.0	56.2	19.7	53.7	77.2	54.2	62.1	73.6	4	
JRB-18	39.1	131.7	110.0	54.5	90.9	38.5	75.5	50.1	61.3	72.4	5	
RBL-6 (NC)	43.8	96.9	111.0	41.3	43.1	27.0	79.7	55.0	50.6	60.9	7	
K-1(Bidhan-1) (NC)	41.0	178.1	108.0	44.7	27.9	57.2	84.4	50.5	49.6	71.3	6	
Bidhan-2 (NC)	44.4	195.8	118.0	36.5	52.0	48.1	73.3	52.1	58.1	75.4	2	
Mean	**42.0**	**170.8**	**110.4**	**46.2**	**43.6**	**47.2**	**79.8**	**52.0**	**59.0**	**72.3**		
CD at 5%	2.5	45.6	6.3	3.7	9.3	11.9	10.1	7.2	6.7			
CV%	3.3	14.9	8.4	11.7	12.0	14.3	7.0	13.0	6.4			

Table 7.3 IVT (R.bean) : Initial Varietal Trial in Rice bean : Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	Green Forage Yield (q/ha/day)									Dry Matter Yield (q/ha/day)									
	Kalya.	Ranc.	Pusa	Jabal.	Raip.	Palghar.	Bhuban.	Avera.	Rank	Kalya.	Ranc.	Pusa	Jorhat	Jabal.	Raip.	Palghar.	Bhuban.	Avera.	Rank
BFRB-17	2.95	4.84	6.08	2.16	4.65	4.36	3.35	4.06	2	0.45	1.57	1.37	0.41	0.39	0.86	0.55	0.74	0.79	3
JRBJ-06-3	3.05	4.29	5.82	3.15	5.16	4.01	2.24	3.96	4	0.44	1.55	1.31	0.57	0.59	0.97	0.51	0.46	0.80	2
JRB-19	2.92	4.59	6.02	2.71	4.52	4.45	2.72	3.99	3	0.44	1.46	1.33	0.72	0.49	0.84	0.57	0.58	0.80	2
JRB-18	2.83	4.91	6.23	1.98	4.43	4.11	2.66	3.88	6	0.44	1.63	1.37	0.70	0.35	0.82	0.52	0.57	0.80	2
RBL-6 (NC)	3.43	6.11	6.23	1.45	6.41	4.52	2.25	4.34	1	0.52	1.94	1.35	0.53	0.27	1.19	0.57	0.46	0.85	1
K-1(Bidhan-1) (NC)	2.76	4.22	5.88	2.93	4.91	4.15	2.29	3.88	6	0.41	1.40	1.33	0.57	0.54	0.92	0.53	0.48	0.77	4
Bidhan-2 (NC)	2.93	4.37	6.63	2.40	4.31	4.28	2.51	3.92	5	0.44	1.52	1.43	0.47	0.43	0.80	0.54	0.52	0.77	4
Mean	**2.98**	**4.76**	**6.13**	**2.40**	**4.91**	**4.27**	**2.57**	**4.00**		**0.45**	**1.58**	**1.36**	**0.57**	**0.44**	**0.91**	**0.54**	**0.54**	**0.80**	

Table 7.4 IVT (R.bean) : Initial Varietal Trial in Rice bean : Crude Protein Yield (q/ha) & Crude Protein (%)

Entries	Crude Protein Yield (q/ha)						Crude protein (%)					
	Imphal	Jabalpur	Raipur	Bhubane.	Average	Rank	Imphal	Jabalpur	Raipur	Bhubane.	Average	Rank
BFRB-17	1.0	5.7	11.2	11.9	7.4	2	2.3	13.5	14.1	15.2	11.3	3
JRBJ-06-3	0.7	8.8	12.9	7.9	7.6	1	2.3	13.8	14.5	14.9	11.4	2
JRB-19	0.5	7.2	10.7	8.8	6.8	4	3.2	13.5	13.9	14.2	11.2	4
JRB-18	3.4	5.0	10.3	9.2	7.0	3	3.7	13.2	13.6	15.0	11.4	2
RBL-6 (NC)	2.5	3.5	11.9	7.5	6.3	6	5.6	13.2	14.8	14.9	12.1	1
K-1(Bidhan-1) (NC)	1.0	7.8	12.1	6.9	7.0	3	3.6	13.7	14.3	14.0	11.4	2
Bidhan-2 (NC)	2.4	6.5	9.7	8.3	6.7	5	4.6	13.6	13.2	14.3	11.4	2
Mean	**1.6**	**6.4**	**11.3**	**8.6**	**7.0**		**3.6**	**13.5**	**14.1**	**14.6**	**11.5**	

Table 7.5 IVT (R.bean) : Initial Varietal Trial in Rice bean : Plant Height (cm)

Entries	Kalyani	Ranchi	Jorhat	Imphal	Jabalpur	Raipur	Palghar	Bhubaneswar	Average	Rank
BFRB-17	121.1	132.0	115.7	138.7	92.6	173.6	148.7	205.7	141.0	4
JRBJ-06-3	119.1	121.0	126.9	119.3	105.5	210.9	133.9	184.7	140.2	5
JRB-19	118.5	120.0	160.5	174.9	93.6	154.8	159.9	198.2	147.6	2
JRB-18	117.8	130.0	158.2	190.5	89.6	193.7	149.6	194.7	153.0	1
RBL-6 (NC)	119.6	100.0	147.4	109.4	79.0	139.9	160.3	181.2	129.6	6
K-1(Bidhan-1) (NC)	119.1	121.0	109.9	122.9	102.9	150.0	130.2	177.5	129.2	7
Bidhan-2 (NC)	117.6	120.0	139.4	153.7	86.8	190.6	151.1	192.5	144.0	3
Mean	**119.0**	**120.6**	**136.9**	**144.2**	**92.9**	**173.4**	**147.7**	**190.6**	**140.6**	

Table 7.6 IVT (R.bean) : Initial Varietal Trial in Rice bean : Leaf Stem Ratio

Entries	Kalyani	Ranchi	Pusa	Jorhat	Imphal	Jabalpur	Raipur	Palghar	Bhuban.	Average	Rank
BFRB-17	0.58	0.86	0.99	0.95	0.55	0.69	0.70	0.83	1.21	0.82	1
JRBJ-06-3	0.65	0.80	0.98	1.08	0.75	0.82	0.77	0.55	0.89	0.81	2
JRB-19	0.50	0.91	1.01	0.80	0.75	0.75	0.67	0.90	1.04	0.81	2
JRB-18	0.50	0.82	0.99	0.94	0.51	0.64	0.76	0.86	1.01	0.78	3
RBL-6 (NC)	0.50	0.78	0.98	0.97	0.75	0.48	0.62	0.92	0.87	0.76	4
K-1(Bidhan-1) (NC)	0.50	0.68	0.99	0.77	0.77	0.78	0.64	0.51	0.84	0.72	6
Bidhan-2 (NC)	0.41	0.73	1.01	0.85	0.52	0.70	0.73	0.84	0.97	0.75	5
Mean	**0.52**	**0.80**	**0.99**	**0.91**	**0.66**	**0.69**	**0.70**	**0.77**	**0.98**	**0.78**	

8. VTBN-2013 (1st Year): Varietal Trial in Bajra Napier Hybrid (Perennial)

A varietal trial in Bajra Napier Hybrid comprising eight entries and three checks was established in Kharif-2013 at 18 locations in five zones of the country. Crop being perennial in nature, entries are in coded names. This year is considered as establishment year and data will be reported from 2014 onwards.

9. VT Sehima-2013 (1st year): Varietal Trial in *Sehima* (Perennial)

A varietal evaluation trial in *Sehima* comprising six entries and one check was established in Kharif-2013 at 15 locations in four zones of the country. Crop being perennial in nature, entries are in coded names. This year is considered as establishment year and data will be reported from 2014 onwards.

10. VT *Dichanthium*-2013 (1st Year): Varietal Trial in *Dichanthium* (Perennial)

A varietal trial in *Dichanthium* comprising seven entries and one check was established in Kharif-2013 at 15 locations in four zones of the country. Crop being perennial in nature, entries are in coded names. This year is considered as establishment year and data will be reported from 2014 onwards.

11. VT *Cenchrus ciliaris*-2013 (1st Year): Varietal Trial in *C. ciliaris* (Perennial)

A varietal trial in *Cenchrus ciliaris* comprising seven entries and two checks was established in Kharif-2013 at 11 locations in three zones of the country. Crop being perennial in nature, entries are in coded names. This year is considered as establishment year and data will be reported from 2014 onwards.

12. VT *Clitoria ternatea* 2013 (1st Year): Varietal Trial in *Clitoria ternatea* (Perennial)

In *Clitoria ternatea*, a varietal evaluation trial comprising seven entries was established initially in Kharif-2013 at eight locations. This is the first year of evaluation and data has been reported from seven locations. Crop being perennial in nature, entries are in coded form as from VTCT-1 to VTCT-7. Decoding of entries will be done after completion of the trial. For green forage yield entries VTCT-7, VTCT-3 and VTCT-1 were superior. For dry matter yield, entries VTCT-7, VTCT-1, VTCT-3, and VTCT-4 registered superiority. For fodder production potential (q/ha/day), entries VTCT-2, VTCT-5 and VTCT-7 for green forage yield whereas entries VTCT-6, VTCT-3 and VTCT-1 for dry matter yield were good performer.

For quality parameters, entry VTCT-1 for crude protein yield (q/ha) and entry VTCT-2 for crude protein content (%) registered superiority. For the character plant height, entry VTCT-2 (116.2 cm) and for leafiness, entry VTCT-3 (1.89) ranked first. **(Table Reference: 12.1 to 12.5)**

Table 12.1 VT Clitoria-2013 (1st year) Varietal Trial in *Clitoria ternatea* (Perennial): Green Forage Yield (q/ha) &Dry Matter Yield (q/ha)

Entries	Green Forage Yield (q/ha)									Dry Matter Yield (q/ha)								
	Bikan.	Anand	Rahuri	Urulika.	Jhansi	Jabal.	Ludhi.	Avera.	Rank	Bikan.	Anand	Rahuri	Urulik.	Jhansi	Jabal.	Ludhi.	Avera.	Rank
VTCT-1	69.0	369.0	123.6	442.8	187.5	89.7	254.6	219.5	3	14.6	89.2	34.1	96.4	47.9	15.0	73.9	53.0	2
VTCT-2	81.1	383.0	112.3	382.1	186.1	108.3	207.9	208.7	6	18.0	93.5	33.7	81.4	48.2	18.7	67.4	51.6	6
VTCT-3	42.0	389.0	95.3	478.5	189.6	108.0	243.7	220.9	2	8.1	83.9	27.5	106.8	47.4	18.3	76.7	52.7	3
VTCT-4	39.0	356.0	122.0	453.5	183.3	139.1	217.9	215.8	4	8.2	89.7	34.4	95.6	49.2	24.5	66.4	52.6	4
VTCT-5	88.9	372.0	113.6	441.0	187.5	102.2	193.8	214.1	5	19.2	93.0	31.4	91.6	51.8	17.2	61.9	52.3	5
VTCT-6	55.3	382.0	107.7	407.1	166.7	77.2	250.6	206.6	7	12.5	89.1	32.0	84.8	40.3	12.3	76.0	49.6	7
VTCT-7	80.4	393.0	127.3	462.4	163.4	95.8	275.1	228.2	1	16.0	90.4	38.4	95.3	46.3	15.8	86.6	55.5	1
Mean	**65.1**	**377.7**	**114.5**	**438.2**	**180.6**	**102.9**	**234.8**	**216.3**		**13.8**	**89.8**	**33.1**	**93.1**	**47.3**	**17.4**	**72.7**	**52.5**	
CD at 5%	12.5	18.4	14.9	46.6	16.3	21.4	29.1			3.0	4.4	4.3	10.5	5.9	4.4	10.2		
CV%	13.4	3.3	8.8	10.0	6.1	14.0	8.3			14.9	3.3	8.7	11.4	8.3	17.1	9.4		

Table 12.2 VT Clitoria-2013 (1st year) Varietal Trial in *Clitoria ternatea* (Perennial): Green Forage Yield (q/ha/day) & Dry Matter Yield (q/ha/day)

Entries	Green Forage Yield (q/ha/day)					Dry Matter Yield (q/ha/day)				
	Bikaner	Anand	Jabalpur	Average	Rank	Bikaner	Anand	Jabalpur	Average	Rank
VTCT-1	0.87	2.64	0.88	1.46	4	0.19	0.64	0.14	1.35	3
VTCT-2	1.03	2.74	1.06	1.61	1	0.23	0.67	0.18	1.07	7
VTCT-3	0.53	2.78	1.05	1.45	5	0.10	0.60	0.18	1.46	2
VTCT-4	0.49	2.54	1.37	1.47	3	0.10	0.64	0.24	1.23	4
VTCT-5	1.12	2.66	1.00	1.59	2	0.24	0.66	0.16	1.18	5
VTCT-6	0.70	2.73	0.80	1.41	6	0.16	0.64	0.12	1.57	1
VTCT-7	1.02	2.81	0.93	1.59	2	0.20	0.65	0.15	1.17	6
Mean	**0.82**	**2.70**	**1.01**	**1.51**		**0.17**	**0.64**	**0.17**	**1.29**	

Table 12.3 VT Clitoria-2013 (1st year) Varietal Trial in*Clitoria ternatea* (Perennial): Crude Protein Yield (q/ha) & CP(%)

Entries	Crude protein Yield(q/ha)						CP (%)					
	Anand	Rahuri	Urulika.	Jabalpur	Average	Rank	Anand	Rahuri	Urulika.	Jabalpur	Average	Rank
VTCT-1	18.7	7.6	13.3	2.1	10.4	1	19.6	22.3	13.8	13.9	17.4	2
VTCT-2	18.3	7.8	11.6	2.7	10.1	2	19.0	23.2	14.3	14.3	17.7	1
VTCT-3	14.7	5.2	15.3	2.6	9.4	6	17.9	18.8	14.4	14.2	16.3	4
VTCT-4	17.5	5.6	13.4	3.5	10.0	3	19.5	16.2	14.0	14.4	16.0	6
VTCT-5	17.7	6.2	13.2	2.4	9.9	4	18.2	19.7	14.4	13.9	16.5	3
VTCT-6	18.6	5.7	12.3	1.7	9.6	5	20.0	17.9	14.5	13.4	16.5	3
VTCT-7	15.2	7.4	13.7	2.2	9.6	5	16.9	19.3	14.3	13.9	16.1	5
Mean	**17.2**	**6.5**	**13.3**	**2.4**	**9.9**		**18.7**	**19.6**	**14.2**	**14.0**	**16.6**	

Table 12.4 VT Clitoria-2013 (1st year) Varietal Trial in*Clitoria ternatea* (Perennial): Plant Height (cm) &Leaf Stem Ratio

Entries	Plant Height (cm)								Leaf Stem Ratio						
	Bikaner	Anand	Rahuri	Urulika.	Jhansi	Jabal.	Avera.	Rank	Bikaner	Rahuri	Urulika.	Jhansi	Jabal.	Avera.	Rank
VTCT-1	86.0	110.1	60.0	94.3	87.1	106.4	90.7	6	1.86	2.17	1.71	1.60	0.78	1.62	2
VTCT-2	120.0	230.0	52.6	96.6	90.0	107.9	116.2	1	2.00	1.20	1.16	1.46	1.13	1.39	4
VTCT-3	95.0	131.1	57.3	92.6	81.3	108.2	94.2	4	3.17	1.86	1.94	1.40	1.07	1.89	1
VTCT-4	94.0	135.3	61.0	97.4	84.3	110.3	97.1	2	1.01	1.25	1.54	1.47	1.21	1.30	6
VTCT-5	103.0	113.7	61.7	98.8	80.2	107.6	94.2	4	1.70	1.00	1.66	1.40	1.02	1.36	5
VTCT-6	103.0	130.3	58.9	97.0	79.7	106.1	95.8	3	2.75	1.43	1.54	1.49	0.87	1.62	2
VTCT-7	74.0	127.1	59.4	98.5	85.2	106.9	91.8	5	2.92	1.00	1.64	1.59	0.8	1.59	3
Mean	**96.4**	**139.7**	**58.7**	**96.5**	**84.0**	**107.6**	**97.1**		**2.20**	**1.41**	**1.60**	**1.49**	**0.98**	**1.54**	

Table 12.5 VT Clitoria-2013 (1st year) Varietal Trial in*Clitoria ternatea* (Perennial): ADF (%)

Entries	ADF (%)		NDF(%)		IVDMD (%)	
	Rahuri	Rank	Rahuri	Rank	Rahuri	Rank
VTCT-1	37.4	1	41.8	1	67.3	1
VTCT-2	40.4	2	47.0	2	65.5	2
VTCT-3	42.2	3	52.0	3	64.5	3
VTCT-4	49.6	7	55.2	4	60.2	7
VTCT-5	44.4	4	50.2	4	63.2	4
VTCT-6	46.5	5	52.4	5	62.0	5
VTCT-7	47.6	6	52.6	6	61.4	6
Mean	**44.0**		**50.2**		**63.4**	

13. VT Sewan-2010 (4th Year): Varietal Trial in Sewan Grass (*Lasiurus sindicus*) (Perennial)

A varietal trial in Sewan comprising seven entries was established in Kharif-2010 at five locations of North West zone. This is being the 4th and final year of evaluation hence all the entries are decoded. The entry CAZRI/BKN/08-10 did not germinate/poorly germinate at all the Centers; hence data of this entry has not been reported by any centre. The results obtained from different centers clearly revealed that entries RLSB-11-50 and RLSB-7-50 registered superiority both for green forage and dry matter yield (q/ha). For fodder production potential (q/ha/day), again entry RLSB-11-50 ranked first both for green forage as well as dry matter production potential.

For plant height and leafiness, entry CAZRI-30-5 ranked first. After compiling the data over the years (2011, 2012, 2013), results clearly revealed that for the character green forage yield (q/ha),entries RLSB-11-50 (10.0%), RLSB-7-50 (6.0%), RLSB-11-49 (2.9%) and CAZRI-30-5 (2.3%) and entries RLSB-11-50 (14.1%), RLSB-7-50 (5.4%) and RLSB-11-49 (2.1%) for dry matter yield (q/ha) were superior. **(Table Reference: 13.1 to 13.4)**

Table 13.1 VT Sewan-2010(4th Year): Varietal trial in Sewan Grass (*Lasiurus sindicus*): Green Forage Yield (q/ha) & Dry Matter Yield(q/ha)

Entries	Green Forage Yield (q/ha)					Dry Matter Yield (q/ha)				
	Jodhpur	Bikaner	Average	Rank	Superiority	Jodhpur	Bikaner	Average	Rank	Superiority
RLSB-4-26	88.7	234.6	161.7	5		39.2	123.7	81.5	5	
RLSB-11-50	80.5	299.0	189.8	1	12.9	35.1	163.7	99.4	1	17.2
RLSB-11-49	89.5	242.8	166.1	4		42.3	124.7	83.5	4	
CAZRI-30-5	99.1	245.9	172.5	3	2.7	45.3	122.0	83.7	3	
RLSB-7-45	84.4	189.8	137.1	6		38.8	100.9	69.9	6	
RLSB-7-50	98.4	263.6	181.0	2	7.7	43.8	137.7	90.7	2	7.0
Mean	**90.1**	**245.9**	**168.0**			**40.8**	**128.8**	**84.8**		
CD at 5%	NS	39.3				NS	29.3			
CV%	24.9	8.8				26.9	12.5			

Table 13.2 VT Sewan-2010(4th Year): Varietal trial in Sewan Grass (*Lasiurus sindicus*): Green Forage Yield (q/ha/day) & Dry Matter Yield(q/ha/day)

Entries	Green Forage Yield (q/ha/day)				Dry Matter Yield (q/ha/day)			
	Jodhpur	Bikaner	Average	Rank	Jodhpur	Bikaner	Average	Rank
RLSB-4-26	0.68	2.97	1.83	5	0.30	1.57	0.94	5
RLSB-11-50	0.62	3.78	2.20	1	0.27	2.07	1.17	1
RLSB-11-49	0.69	3.07	1.88	4	0.33	1.58	0.96	3
CAZRI-30-5	0.76	3.11	1.94	3	0.35	1.54	0.95	4
RLSB-7-45	0.65	2.40	1.53	6	0.30	1.28	0.79	6
RLSB-7-50	0.76	3.34	2.05	2	0.34	1.74	1.04	2
Mean	**0.69**	**3.11**	**1.90**		**0.32**	**1.63**	**0.97**	

Table 13.3 VT Sewan-2010(4th Year): Varietal trial in Sewan Grass (*Lasiurus sindicus*): Plant Height (cm) & Leaf Stem Ratio

Entries	Plant Height (cm)				Leaf stem ratio			
	Jodhpur	Bikaner	Average	Rank	Jodhpur	Bikaner	Average	Rank
RLSB-4-26	116.8	96.0	106.4	4	1.31	1.33	1.32	5
RLSB-11-50	112.8	107.0	109.9	2	1.66	1.28	1.47	3
RLSB-11-49	103.5	97.0	100.3	6	1.02	1.09	1.06	6
CAZRI-30-5	108.9	140.0	124.5	1	2.45	1.25	1.85	1
RLSB-7-45	101.8	108.0	104.9	5	1.47	1.30	1.39	4
RLSB-7-50	113.3	105.0	109.2	3	1.58	1.41	1.50	2
Mean	**109.5**	**108.8**	**109.2**		**1.58**	**1.28**	**1.43**	

Table 13.4 VT Sewan-2010(2010-2013): Varietal Trial in Sewan (*Lasiurus sindicus*): Green Forage Yield (q/ha) & Dry Matter Yield(q/ha) over three years

Entries	Green Forage Yield (q/ha)						Dry Matter Yield (q/ha)					
	2011	2012	2013	Average	Rank	Superiority	2011	2012	2013	Average	Rank	Superiority
RLSB-4-26	138.7	129.9	161.7	143.4	5		40.6	52.9	81.5	58.3	5	
RLSB-11-50	168.9	151.6	189.8	170.1	1	10.0	50.5	65.9	99.4	71.9	1	14.1
RLSB-11-49	166.0	145.2	166.1	159.1	3	2.9	48.2	61.1	83.5	64.3	3	2.1
CAZRI-30-5	172.1	129.8	172.5	158.1	4	2.3	51.1	49.8	83.7	61.5	4	
RLSB-7-45	153.6	107.7	137.1	132.8	6		44.1	52.8	69.9	55.6	6	
RLSB-7-50	166.3	144.3	181.0	163.9	2	6.0	49.4	59.0	90.7	66.4	2	5.4
Mean	**160.9**	**134.8**	**168.0**	**154.6**			**47.3**	**56.9**	**84.8**	**63.0**		

14. VTCS-2010 (4th year): Varietal Trial in *Cenchrus setigerus* (Perennial)

In *Cenchrus setigerus*, a varietal evaluation trial comprising seven entries and one check variety namely CAZRI-76 was established in Kharif 2010 at 12 locations of the country. This is being the 4th and final year of evaluation hence all the entries are decoded and data has been reported from nine locations. For green forage yield, entries RCSB-02-08 (11.4%), CAZRI-550 (10.1%) and CAZRI-175 (5.7%) in North West zone exhibited their superiority whereas none of the entries established their superiority in any other zone. At national level, Check CAZRI-76 maintained superiority. Similarly for dry matter yield (q/ha), only one entry RCSB-02-08 (32.8%) proved its superiority in North West zone whereas in other zones as well as at national level national check maintained superiority.

For fodder production potential (q/ha/day), again RCSB-02-08 ranked first both for green forage as well as dry matter production potential. For quality parameters, national check CAZRI-76 adjudged best performer both for crude protein yield (q/ha) as well as crude protein content (%). For other quality parameters, RCSB-02-52 for ADF (%) and NDF (%) registered its superiority. For plant height, entry CAZRI-175 (75.8 cm) and for leafiness, entry RCSB-02-08 (2.08) were superior.

After compiling the data over the years (2011, 2012, 2013), results clearly revealed that check variety CAZRI-76 maintained superiority both for green forage yield and dry matter yield (q/ha).

(Table Reference: 14.1 to 14.6)

Table 14.1 VT *Cenchrus setigerus*-2010 (4th Yr): Varietal Trial in*Cenchrus setigerus*: Green Forage Yield (q/ha)

Entries	North West Zone							Central Zone						South Zone		All India	
	Jalore	Pali	Jodhp.	Bikaner	Avera.	Rank	Super%	Jhansi	Rahuri	Dhari	Anand	Avera.	Rank	Coimb.	Rank	Avera.	Rank
RCSB-02-46	231.7	33.3	45.6	200.0	127.6	4		103.9	69.6	66.4	92.0	83.0	7	483.6	7	147.3	6
RCSB-02-52	198.3	42.3	53.4	194.5	122.1	5		56.9	69.3	63.3	108.0	74.4	8	474.4	8	140.1	8
RCSB-02-08	220.0	57.2	46.8	244.7	142.2	1	11.4	70.3	74.0	74.1	119.0	84.3	5	507.9	5	157.1	4
CAZRI-175	236.7	42.0	53.8	207.3	134.9	3	5.7	81.3	85.1	70.2	109.0	86.4	4	524.8	4	156.7	5
CAZRI-296	236.7	41.1	38.4	110.3	106.6	7		95.1	63.0	73.9	119.0	87.8	3	493.3	6	141.2	7
CAZRI-550	263.0	46.9	47.7	204.6	140.5	2	10.1	97.2	75.4	77.1	106.0	88.9	2	565.5	3	164.8	2
CSR-2	238.3	59.6	42.1	144.2	121.0	6		68.2	93.1	66.4	109.0	84.2	6	608.3	2	158.8	3
CAZRI-76 (NC)	188.3	66.9	58.6	196.7	127.6	4		105.0	115.5	74.5	173.0	117.0	1	641.9	1	180.0	1
Mean	**226.6**	**48.6**	**48.3**	**187.8**	**127.8**			**84.7**	**80.6**	**70.7**	**116.9**	**88.2**		**537.5**		**152.3**	
CD at 5%	17.5	8.0	NS	59.6				7.2	26.1	21.5	14.7			33.2			
CV%	4.3	15.5	23.0	18.1				4.8	18.5	17.4	7.2			3.5			

Table 14.2 VT *Cenchrus setigerus*-2010 (4th Yr): Varietal trial in*Cenchrus setigerus*: Dry matter yield (q/ha)

Entries	North West Zone						Central Zone						South Zone		All India	
	Pali	Jodhpur	Bikaner	Average	Rank	Super%	Jhansi	Rahuri	Dhari	Anand	Avera.	Rank	Coimb.	Rank	Avera.	Rank
RCSB-02-46	8.7	12.9	98.1	39.9	3		62.1	19.8	28.6	24.5	33.8	2	81.9	8	42.1	4
RCSB-02-52	11.1	14.2	91.2	38.8	5		32.9	17.9	23.7	28.8	25.8	8	82.6	7	37.8	7
RCSB-02-08	14.9	12.4	133.0	53.4	1	32.8	31.6	21.9	33.1	30.8	29.4	5	92.7	6	46.3	2
CAZRI-175	11.0	14.0	92.7	39.2	4		32.9	23.2	27.1	31.6	28.7	6	100.5	4	41.6	5
CAZRI-296	10.7	12.2	49.5	24.2	7		43.5	18.4	28.5	32.0	30.6	4	96.8	5	36.5	8
CAZRI-550	12.3	13.5	94.9	40.2	2		47.4	20.0	24.3	31.7	30.9	3	104.6	3	43.6	3
CSR-2	15.6	10.8	63.4	29.9	6		25.9	26.4	25.7	31.3	27.3	7	113.5	2	39.0	6
CAZRI-76 (NC)	17.5	16.9	86.4	40.2	2		73.4	33.0	31.0	50.4	47.0	1	118.0	1	53.3	1
Mean	**12.7**	**13.4**	**88.6**	**38.2**			**43.7**	**22.6**	**27.7**	**32.6**	**31.7**		**98.8**		**42.5**	
CD at 5%	2.1	NS	28.7				4.3	7.2	9.0	4.2			6.7			
CV%	15.5	25.3	18.5				2.6	18.3	18.5	7.4			3.9			

Table 14.3 VT *Cenchrus setigerus*-2010 (4th Yr): Varietal trial in*Cenchrus setigerus*: Green Forage Yield (q/ha/day)

Entries	Green Forage Yield (q/ha/day)						Dry Matter Yield (q/ha/day)				
	Jodhpur	Bikaner	Dhari	Anand	Average	Rank	Jodhpur	Bikaner	Anand	Average	Rank
RCSB-02-46	0.53	2.53	1.22	0.24	1.13	6	0.15	1.24	0.06	0.48	3
RCSB-02-52	0.96	2.46	1.13	0.28	1.21	4	0.25	1.15	0.07	0.49	2
RCSB-02-08	0.70	3.10	1.41	0.31	1.38	1	0.18	1.68	0.08	0.65	1
CAZRI-175	0.79	2.62	1.28	0.28	1.24	3	0.20	1.17	0.08	0.48	3
CAZRI-296	0.37	1.40	1.35	0.31	0.86	8	0.12	0.63	0.08	0.28	6
CAZRI-550	0.50	2.59	1.42	0.27	1.19	5	0.14	1.20	0.08	0.47	4
CSR-2	0.56	1.82	1.19	0.28	0.96	7	0.14	0.80	0.08	0.34	5
CAZRI-76 (NC)	0.71	2.49	1.36	0.45	1.25	2	0.20	1.09	0.13	0.47	4
Mean	**0.64**	**2.38**	**1.29**	**0.30**	**1.15**		**0.17**	**1.12**	**0.08**	**0.46**	

Table 14.4 VT *Cenchrus setigerus*-2010 (4th Yr): Varietal trial in*Cenchrus setigerus*: Crude Protein Yield (q/ha)

Entries	Crude Protein Yield (q/ha)				Crude Protein (%)			
	Rahuri	Anand	Average	Rank	Rahuri	Anand	Average	Rank
RCSB-02-46	1.3	1.6	1.5	5	6.6	6.6	6.6	3
RCSB-02-52	1.3	1.7	1.5	5	7.4	5.7	6.6	3
RCSB-02-08	1.5	1.3	1.4	6	6.8	4.4	5.6	5
CAZRI-175	1.6	1.9	1.8	3	7.0	6.0	6.5	4
CAZRI-296	1.4	2.0	1.7	4	7.4	6.2	6.8	2
CAZRI-550	1.5	2.0	1.7	4	7.4	6.1	6.8	2
CSR-2	2.0	1.8	1.9	2	7.5	5.5	6.5	4
CAZRI-76 (NC)	2.5	3.3	2.9	1	7.5	6.5	7.0	1
Mean	**1.6**	**1.9**	**1.8**		**7.2**	**5.9**	**6.5**	

Table 14.5 VT *Cenchrus setigerus*-2010 (4thYr): Varietal trial in *Cenchrus setigerus*: Plant height (cm) & Leaf stem ratio

Entries	Plant height (cm)								Leaf stem ratio					
	Pali	Jodhpur	Bikaner	Rahuri	Dhari	Anand	Average	Rank	Jodhpur	Bikaner	Rahuri	Dhari	Average	Rank
RCSB-02-46	75.5	68.6	76.0	37.0	73.0	71.9	67.0	8	4.26	1.67	0.89	0.86	1.92	2
RCSB-02-52	73.3	70.7	63.0	32.6	74.0	70.9	64.1	7	3.23	1.71	0.92	0.81	1.67	5
RCSB-02-08	84.7	68.3	65.0	37.6	75.0	77.6	68.0	4	4.08	2.29	1.22	0.74	2.08	1
CAZRI-175	74.7	83.2	98.0	36.6	83.0	79.2	75.8	1	3.05	1.73	1.17	0.74	1.67	5
CAZRI-296	66.5	66.4	98.0	35.8	81.0	72.1	70.0	3	3.57	1.15	1.04	0.79	1.64	6
CAZRI-550	73.7	66.9	75.0	37.0	82.0	72.5	67.9	5	4.04	1.78	1.08	0.71	1.90	3
CSR-2	79.6	71.6	66.0	36.6	73.0	76.2	67.2	6	3.74	1.73	0.96	0.69	1.78	4
CAZRI-76 (NC)	88.5	76.6	59.0	57.3	72.0	84.1	72.9	2	3.00	1.60	0.82	0.84	1.56	7
Mean	**77.1**	**71.5**	**75.0**	**38.8**	**76.6**	**75.6**	**69.1**		**3.6**	**1.7**	**1.0**	**0.8**	**1.8**	

Table 14.6 VT *Cenchrus setigerus*-2010 (4th Yr): Varietal trial in *Cenchrus setigerus*: ADF(%) & NDF (%)

Entries	ADF (%)		NDF (%)	
	Rahuri	Rank	Rahuri	Rank
RCSB-02-46	35.4	2	54.4	3
RCSB-02-52	32.2	1	50.4	1
RCSB-02-08	41.6	7	56.2	5
CAZRI-175	36.6	6	57.0	7
CAZRI-296	35.6	4	55.8	4
CAZRI-550	35.5	3	57.0	7
CSR-2	36.6	5	54.0	2
CAZRI-76 (NC)	36.0	5	56.6	6
Mean	**36.2**		**55.2**	

Table 14.7 VTCS-2010 (2010-2013): Varietal Trial in *Cenchrus setigerus* (Perennial): Pooled Green Forage , Dry Matter Yield (q/ha) over three years

Entries	Green Forage Yield(q/ha)					Dry Matter Yield (q/ha)				
	2011	2012	2013	Average	Rank	2011	2012	2013	Average	Rank
RCSB-02-46	349.5	207.0	147.3	234.6	3	78.9	43.6	42.1	54.9	3
RCSB-02-52	274.9	208.2	140.1	207.7	8	61.8	49.7	37.8	49.8	7
RCSB-02-08	304.6	210.7	157.1	224.1	5	67.5	52.4	46.3	55.4	4
CAZRI-175	374.5	278.9	156.7	270.0	2	83.8	56.4	41.6	60.6	2
CAZRI-296	328.0	207.5	141.2	225.6	4	73.1	45.6	36.5	51.7	5
CAZRI-550	293.0	194.9	164.8	217.6	7	63.2	42.2	43.6	49.7	6
CSR-2	300.9	201.8	158.8	220.5	6	61.2	44.8	39.0	48.3	8
CAZRI-76 (NC)	426.3	307.7	180.0	304.7	1	98.5	64.2	53.3	72.0	1
Mean	**331.5**	**227.1**	**155.8**	**238.1**		**73.5**	**49.9**	**42.5**	**55.3**	

CHAPTER-2

FORAGE CROP PRODUCTION

Forage Production Technology

The forage crop production programme was executed at 19 locations in five zones. In total 20 experiments were conducted, out of which 9 in network (8 coordinated and 1 AVT based) and 11 in location specific mode were undertaken with the aim to generate region specific forage production technologies. The main emphasis of natural resource management under forage crops was to increase system productivity and resource use optimization in forage based systems. The salient research achievements have been discussed in this chapter for the forage crop production during *kharif* 2013.

A. COORDINATED TRIALS

AST-1: Resource conservation through forages

AST-1.1: Effect of vegetative barrier and improved forage species on conservation of degraded grassland (Rainfed conditions) **(Location: Hill Zone – Palampur)**

AST-1.2: Effect of different tillage practices on productivity of forage crop in the prevalent crop sequence (Irrigated conditions) **(Location: North West Zone – Ludhiana and Pantnagar)**

AST-1.3: Effect of planting methods and forage crop combinations on fodder productivity through moisture conservation **(Location: Central Zone – Rahuri, Jabalpur, Anand and Urulikanchan)**

AST-1.4: Effect of moisture conservation practices on productivity of perennial grasses **(Location: North East Zone – Jorhat, Faizabad, Ranchi, Bhubaneswar and Kalyani)**

AST-1.5 (a): Intensive forage production through silvipasture system under rainfed ecosystem **(Location: South Zone – Hyderabad, Coimbatore and Mandya)**

AST-1.5 (b): Cassava based sustainable alley farming system for rainfed areas of the humid tropics **(Location: South Zone – Vellayani)**

This experiment (AST-1) was initiated in kharif 2009 (Initial soil studies) and executed in kharif 2010 at 17 locations to study the effect of resource conservation technologies (RCT) on forage yield, physico-chemical properties of soil and economics of the system. The third year results of the experiment have been reported in Rabi 2012-13.The results of the fourth year experimentation will be reported in annual report of Rabi 2013-14.

AST-2: Effect of growing environment and nitrogen levels on production and quality of BN hybrid. [Table Reference: 2(a) to 2 (g)]

Locations: Palampur, Ludhiana, Anand, Rahuri and Hyderabad

A field experiment was started in Kharif 2011 (as establishment year) at five locations to assess the effect of growing environment and N levels on yield, quality and anti-nutritional components. The treatment consisted of two growing environments (shaded & unshaded) and five levels of nitrogen (control, 50, 75, 100 & 125% of recommended N) laid out in RBD with three replications.

On mean basis, growing of bajra Napier hybrid under unshaded environment recorded higher GFY (692.6 q/ha), DMY (138.2 q/ha), and CPY (14.9 q/ha) over shaded environment (539.9, 96.4 and 11.7q/ha, respectively). The magnitude of increase for GFY, DMY and CPY was 28.28, 43.36 and 27.35%. In general, highest yields were recorded at Ludhiana and lowest at Hyderabad. Location wise, at all the locations growing of BN hybrid under unshaded condition recorded remarkably higher yield, whereas, on mean basis as well as location wise (except Palampur and Rahuri) under shaded condition, BN hybrid recorded higher crude protein content over unshaded condition. The green fodder, DMY, CPY and crude protein content of BN hybrid increased consistently with increasing levels of nitrogen up to 125% of recommended N. The magnitude of increase for GFY on location mean basis was 68.0, 29.6, 14.7 and 7.9% over control, 50, 75, and 100% of recommended N, respectively.

Unshaded environment produced taller plants with more number of tillers of BN hybrid over shaded environment on mean basis (Table-2c). Plant height and number of tiller / plant increased gradually with higher levels of recommended N up to 125% of RDN. Maximum plant height of BN hybrid was recorded at Hyderabad and lowest at Ludhiana. Growing of BN hybrid under unshaded environment fetched higher net return and benefit cost ratio at Palampur, Hyderabad and Ludhiana over shaded environment. Net monetary return and B: C ratio increased consistently with increasing levels of nitrogen up to 100 % of recommended N on mean basis (Table-2d).

Anti-quality components of BN hybrid differed under different growing environment and nitrogen levels. On mean basis, higher values of NDF (%), ADF (%) and oxalic acid (%) were recorded under unshaded condition over shaded condition. In general, higher NDF (%) and ADF (%) in BN hybrid was recorded at Anand and lowest at Ludhiana. Lower values of nitrate content (ppm) was recorded under unshaded condition (1035 ppm) over shaded condition (1146 ppm) on mean basis. At Palampur, growing of BN hybrid under shaded condition recorded higher nitrate content (3000 ppm) over unshaded condition (2820 ppm). Location wise highest values of nitrate content in dry matter were recorded at Palampur and lowest at Hyderabad.

On mean basis, growing of BN hybrid without nitrogen (control) recorded highest values of NDF (72.2%) and ADF (49.9%) over its higher levels. Application of highest level of nitrogen (125% of recommended N) recorded highest values of nitrate content (1256 ppm) over its lower levels on mean basis. However, application of 100% recommended N to BN hybrid recorded maximum oxalic acid content (1.92%) in the fodder over its lower as well as higher level. IVDMD value was higher under shaded condition (68.4 %) at Rahuri over unshaded condition (66.0%).

At Hyderabad and Rahuri, available N, P and K in the soil remained unaffected under shaded and unshaded growing environments and among nitrogen levels. Higher OC (%) and pH was recorded under shaded environment at Rahuri in comparison to unshaded condition after the end of second year. At Palampur, soil fertility status in terms of available N, P and K and organic carbon was toward higher side under shaded over unshaded growing environment after the end of second year. Application of graded levels of nitrogen to the BN hybrid recorded consistent increase in available N in the soil after crop season, whereas non-remarkable variation in soil available P, K and OC% was observed by application of different levels of nitrogen (Table 2g).

Table- 2(a): Effect of growing environment and nitrogen levels on green fodder and dry matter yield of bajra napier hybrid

Treatment	Green fodder yield (q/ha)						Dry matter yield (q/ha)					
	Palampur (2 cuts)	Ludhiana (3 cuts)	Anand (8 cuts)	Rahuri (4cuts)	Hyderabad (4 cuts)	Mean	Palampur	Ludhiana	Anand	Rahuri	Hyderabad	Mean
A. Growing environment												
Shaded	217.0	1189.0	763.0	434.4	96.3	539.9	50.8	191.3	130.4	85.2	24.2	96.4
Unshaded	338.0	1492.0	1064.0	459.8	109.1	692.6	80.2	251.5	238.0	93.6	27.8	138.2
SEm±	3.5	24.8	30.9	2.2	2.4		0.8	4.30	6.1	0.2	0.7	
CD at 5%	10.4	150.8	188.1	13.1	7.2		2.5	26.1	36.8	1.3	2.1	
B. Nitrogen levels												
Control	160.9	926.0	743.0	267.3	98.9	439.2	39.5	155.4	142.2	51.4	24.6	82.6
50% of recommended N	245.8	1190.0	871.0	438.0	101.5	569.3	57.3	198.2	173.0	85.9	24.1	107.7
75% of recommended N	288.2	1417.0	921.0	479.1	109.5	642.9	66.8	234.6	185.0	95.2	28.1	121.9
100% of recommended N	332.4	1552.0	966.0	504.2	106.2	692.2	79.9	252.1	197.9	102.1	26.9	131.8
125% of recommended N	360.3	1618.0	1066.0	546.9	97.4	737.7	84.1	266.9	223.1	112.5	26.4	142.6
SEm±	5.6	39.9	31.0	9.2	3.8		1.3	6.4	6.1	1.9	1.1	
CD at 5%	16.5	118.6	93.0	27.7	NS		3.9	18.9	18.3	5.7	NS	
C. Interaction: G X N												
SEm±	7.9	56.4	43.3	13.0	5.4		1.9	9.0	8.6	2.7	0.6	
CD at 5%	23.4	NS	NS	39.1	NS		5.5	NS	25.9	8.0	NS	
CV%	4.9	7.3	8.3	-	9.1		4.9	7.0	8.1	-	10.3	

Table- 2(b): Effect of growing environment and nitrogen levels on crude protein yield and protein content of bajra napier hybrid

Treatment	Crude protein yield (q/ha)					Crude protein (%)					
	Palampur	Anand	Rahuri	Ludhiana	Mean	Palampur	Anand	Rahuri	Hyderabad	Ludhiana	Mean
A. Growing environment											
Shaded	4.6	15.7	6.6	19.7	11.7	8.7	12.9	7.7	7.3	10.1	9.3
Unshaded	7.9	22.6	7.5	21.5	14.9	9.6	10.2	7.9	6.6	8.4	8.5
SEm±	0.2	0.6	0.03	0.3		0.1		0.04	0.1	0.1	
CD at 5%	0.6	3.7	0.15	1.9		0.4		0.22	0.3	0.8	
B. Nitrogen levels											
Control	3.2	13.8	3.6	11.4	8.0	7.9	10.8	7.0	6.3	7.4	7.9
50% of recommended N	4.8	18.0	6.6	17.7	11.8	8.3	11.5	7.6	6.8	9.1	8.7
75% of recommended N	6.4	19.3	7.6	22.3	13.9	9.6	11.6	8.0	6.8	9.6	9.1
100% of recommended N	8.1	21.6	8.2	24.3	15.6	10.1	12.1	8.1	7.7	9.8	9.6
125% of recommended N	8.6	23.1	9.2	27.2	17.0	10.1	11.9	8.2	7.1	10.3	9.5
SEm±	0.3	0.7	0.17	0.5		0.2		0.06	0.2	0.2	
CD at 5%	0.9	2.0	0.51	1.3		0.7		0.18	0.5	0.4	
C. Interaction: G X N											
SEm±		1.0	0.24	0.7		-		0.08	0.2	0.3	
CD at 5%		NS	NS	NS		NS		NS	NS	NS	
CV%		8.7	-	5.6				-	5.7	5.5	

Table- 2(c): Effect of growing environment and nitrogen levels on plant height and number of tillers/plant of bajra napier hybrid

Treatment	Plant height (cm)						Number of tillers / plant			
	Palampur	Ludhiana	Anand	Rahuri	Hyderabad	Mean	Anand	Rahuri	Ludhiana	Mean
A. Growing environment										
Shaded	125.3	54.3	114.6	133.9	134.4	112.5	28.6	18.7	24.1	23.8
Unshaded	129.7	69.8	118.2	133.8	135.6	117.4	40.0	21.3	28.8	30.0
SEm±	-	1.0		1.0	2.1			0.3	0.4	
CD at 5%	-	6.3		NS	NS			1.7	2.4	
B. Nitrogen levels										
Control	89.7	52.1	110.3	107.8	123.5	96.7	31.4	15.3	23.4	23.4
50% of recommended N	125.0	58.2	116.1	125.8	128.8	110.8	32.3	19.0	25.7	25.7
75% of recommended N	136.7	62.9	116.8	136.4	137.9	118.1	34.1	20.6	26.6	27.1
100% of recommended N	141.7	66.9	117.8	144.1	138.6	121.8	35.5	21.4	28.0	28.3
125% of recommended N	144.6	70.3	121.0	155.4	146.1	127.5	38.3	23.7	28.9	30.3
SEm±	-	1.6		1.4	3.3			0.4	1.98	
CD at 5%	-	4.7		4.3	9.7			1.2	0.7	
C. Interaction: G X N										
SEm±	-	2.2		2.0	4.6			0.6	1.0	
CD at 5%	-	NS		NS	NS			NS	NS	
CV%	-	6.1		-	5.9			-	6.1	

Table- 2(d): Effect of growing environment and nitrogen levels on net return and benefit cost ratio of bajra napier hybrid

Treatment	NMR (Rs/ha)				Benefit cost ratio			
	Palampur	Ludhiana	Hyderabad	Mean	Palampur	Ludhiana	Hyderabad	Mean
A. Growing environment								
Shaded	19769	30984	73456	41403	1.51	1.07	4.22	2.27
Unshaded	36918	45326	86304	56183	2.62	1.52	4.78	2.97
SEm±	-	895	-		-	0.02	-	
CD at 5%	-	5443	-		-	0.14	-	
B. Nitrogen levels								
Control	14251	22211	76656	37706	1.42	0.92	4.45	2.26
50% of recommended N	24923	32526	79000	45483	2.06	1.20	4.51	2.59
75% of recommended N	29184	41299	86764	52415	2.06	1.39	4.82	2.76
100% of recommended N	35455	46504	83007	54989	2.44	1.50	4.58	2.84
125% of recommended N	37905	48237	73971	53371	2.32	1.47	4.16	2.65
SEm±	-	1466	-		-	0.04	-	
CD at 5%	-	4355	-		-	0.11		
C. Interaction: G X N								
SEm±	-	2073	-		-	0.05	-	
CD at 5%	-	NS	-		-	NS	-	
CV%	-	9.41	-		-	7.0	-	

Table- 2(e): NDF (%), ADF (%) and IVDMD (%) as influenced by growing environment and nitrogen levels in BN hybrid

Treatment	Neutral Detergent Fibre (%)					Acid Detergent Fiber (%)					IVDMD (%)
	Palampur	Ludhiana	Anand	Rahuri	Mean	Palampur	Ludhiana	Anand	Rahuri	Mean	Rahuri
A. Growing environment											
Shaded	74.8	58.3	78.5	66.2	69.5	55.7	35.5	54.7	47.2	48.3	68.4
Unshaded	71.6	62.9	80.5	67.1	70.5	53.3	37.9	53.6	49.2	48.5	66.0
SEm±		0.9	1.1	0.4		-	0.6	0.1	0.3		0.2
CD at 5%		NS	NS	NS		-	NS	0.9	NS		0.9
B. Nitrogen levels											
Control	74.2	62.9	80.8	70.7	72.2	56.0	37.9	53.3	52.4	49.9	63.9
50% of recommended N	73.8	62.0	79.2	68.3	70.8	54.6	36.8	55.1	49.5	49.0	66.4
75% of recommended N	73.0	61.3	79.8	66.9	70.3	54.3	36.6	54.5	47.6	48.3	67.6
100% of recommended N	72.5	60.0	78.6	65.1	69.1	54.9	36.3	53.5	46.3	47.8	68.6
125% of recommended N	72.7	57.0	79.1	62.1	67.7	52.7	36.0	54.3	45.2	47.1	69.5
SEm±		1.5	1.3	0.7		-	0.9	1.1	0.7		0.5
CD at 5%		4.11	NS	2.1		-	2.5	NS	2.2		1.6
C. Interaction : G X N											
SEm±		2.1	1.9	1.0		-	1.2	1.6	1.0		0.7
CD at 5%		NS	NS	NS		-	NS	NS	NS		NS
CV%		5.9	4.0	-		-	5.9	5.1	-		-

Table- 2(f): Nitrate content (ppm) and oxalic acid (%) as influenced by growing environment and nitrogen levels in BN hybrid

Treatment	Nitrate content (ppm)					Oxalic acid (%)			
	Palampur	Ludhiana	Rahuri	Hyderabad	Mean	Palampur	Rahuri	Hyderabad	Mean
A. Growing environment									
Shaded	3000	930	498	156	1146	2.66	2.05	1.44	2.05
Unshaded	2820	680	492	147	1035	1.69	2.03	1.35	1.69
SEm±	-	12.6	0.5	1.3		-	0.01	0.02	
CD at 5%	-	76.6	3.2	3.9		-	NS	0.05	
B. Nitrogen levels									
Control	2730	350	462	144	922	2.10	1.92	1.32	1.78
50% of recommended N	2820	600	480	149	1012	2.15	2.04	1.38	1.86
75% of recommended N	2890	850	490	154	1096	2.23	2.06	1.42	1.90
100% of recommended N	3020	975	510	151	1164	2.30	2.08	1.38	1.92
125% of recommended N	3080	1250	535	159	1256	2.12	2.11	1.47	1.90
SEm±	-	19.5	3.7	2.1		-	0.02	0.03	
CD at 5%	-	59.1	11.2	6.2		-	0.05	0.08	
C. Interaction : G X N									
SEm±	-	27.6	5.3	3.0		-	0.024	0.04	
CD at 5%	-	NS	15.8	11.6		-	NS	NS	
CV%	-	5.9	-	3.39		-	-	-	

Table- 2(g): Soil properties as influenced by growing environment and nitrogen levels in BN hybrid

Treatments	Hyderabad			Rahuri					Palampur				
	Available nutrients (kg/ha)			Available nutrients (kg/ha)			OC %	pH	Available nutrients (kg/ha)			OC %	pH
	N	P	K	N	P	K			N	P	K		
A. Growing environment													
Shaded	207.5	36.2	502.5	199.0	13.68	534	0.36	7.65	246	13	341	0.80	5.6
Unshaded	203.8	34.8	516.4	195.0	13.65	530	0.34	7.56	239	14	333	0.70	5.5
SEm±	5.3	0.6	4.8	0.9	0.02	1.24	0.001	0.004					
CD at 5%	NS	NS	NS	NS	NS	NS	0.006	0.022					
B. Nitrogen levels													
Control	203.5	34.0	517.5	188.0	13.31	517	0.31	7.54	211	13	333	0.75	5.6
50% of recommended N	204.7	36.0	509.2	193.0	13.59	524	0.35	7.58	225	14	342	0.75	5.6
75% of recommended N	193.3	35.7	522.7	196.5	13.65	533	0.36	7.58	250	13	331	0.77	5.5
100% of recommended N	208.2	35.5	506.3	199.5	13.81	541	0.37	7.67	258	14	337	0.74	5.6
125% of recommended N	218.7	36.3	492.3	207.0	13.97	548	0.37	7.65	269	14	344	0.75	5.6
SEm±	8.4	1.0	7.7	1.37	0.04	1.82	0.004	0.048					
CD at 5%	NS	NS	NS	4.11	0.12	7.45	0.011	NS					
C. Interaction : G X N													
SEm±	11.9	1.4	10.8	1.94	0.06	2.57	0.005	0.067					
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS					
C.V (%)	10.1	6.63	3.7										
Initial													
Unshaded									215	11	324	0.69	5.5
Shaded									236	13	336	0.79	5.4

AST-3: Performance of dual purpose pearl millet as influenced by different cutting management practices and nitrogen levels [Table Reference: 3(a) to 3 (f)]

Location: Anand, Urulikanchan, Bikaner, Mandya, Hyderabad, Dharwad and Jhansi

A field experiment was started during *Kharif* 2012 at six locations to study the effect of cutting management, nitrogen levels and varieties on the performance of dual purpose pearl millet. The treatment consisted of three varieties (BAIF Bajra-1, AVKB-19 and GFB-1), three cutting management practices (no cutting, first cut at 50 DAS and leave for grain, and first cut at 50 DAS & 2nd cut at 40 days after 1st cut and leave for grain) and two levels of nitrogen (100% and 150% of recommended dose of nitrogen) laid out in factorial RBD and replicated three times.

No data was reported from Hyderabad due to delay in sowing and harvesting as well as poor seed setting. Due to continuous rains trial could not be conducted at Jhansi.

The data of second year of experimentation of Anand, Urulikanchan, Bikaner, Mandya and Dharwad are presented in tables 3(a) to 3(f). On location mean basis, planting of BAIF Bajra-1 recorded highest GFY (299.3 q/ha), stover yield (110.4 q/ha) and CPY (6.9 q/ha) and lowest with AVKB-19. Highest DMY (50.3 q/ha) was recorded by GFB-1 on mean basis. GFB-1 variety recorded significantly higher GFY over AVKB-19 and BAIF Bajra-1 at Bikaner but it remained at par with BAIF Bajra-1 at Anand. At Anand, significantly high DMY was recorded by GFB-1 (33.8 q/ha) and lowest with BAIF Bajra-1(26.1 q/ha). BAIF Bajra-1 recorded significantly highest GFY (322.9 q/ha) and DMY (72.7q/ha) at Dharwad, and highest green fodder yield (478.5q/ha) at Urulikanchan. On mean basis cutting of pearl millet at 50 days after sowing and 2nd cut at 40 days after 1st cut and left for grain recorded higher GFY (434.5 q/ha), DMY (73.5 q/ha) and CPY (7.69 q/ha mean of Dharwad, Bikaner and Anand) as compared to first cut at 50 DAS and left for grain. With respect to nitrogen levels, on mean basis, application of 150% recommended dose of nitrogen recorded higher GFY (306.9 q/ha), DMY (51.3 q/ha) and CPY (6.9 q/ha mean of Dharwad, Bikaner and Anand) over 100% of RDN. The magnitude of increase for GFY, DMY and CPY was 14.2, 17.9 and 17.5 percent more over 100% RDN.

On mean basis GFB-1 recorded highest grain yield (9.6 q/ha), whereas highest stover yield (110.4 q/ha) was recorded with BAIF Bajra-1. At Anand GFB-1 variety recorded significantly highest grain yield (6.22 q/ha) over AVKB-19 (4.33 q/ha) and BAIF Bajra-1 (5.65 q/ha). BAIF Bajra-1 produced significantly highest stover yield (120.3 q/ha) over AVKB-19 and GFB-1. At Urulikanchan, BAIF Bajra-1 recorded significantly highest grain (9.5 q/ha) and stover yields (177.4 q/ha) followed by GFB-1 (8.4 q/ha grain yield). At Mandya and Dharwad, GFB-1 recorded highest grain yield (6.0 and 8.0 q/ha, respectively), whereas, BAIF Bajra-1 recorded significantly higher stover yield over rest of the varieties at both the locations (Table 3(b).

On mean basis no cutting of pearl millet varieties recorded highest grain yield (14.4 q/ha) followed by first cut at 50 DAS and left for grain (8.7 q/ha) and lowest being with cutting at 50 DAS & 2nd cut at 40 days after 1st cut and left for grain (3.1q/ha). Similar to grain yield, no cutting practice recorded highest stover yield (150.2q/ha) over rest of the treatments. With respect to nitrogen levels, on mean as well as location basis, application of 150% of RDN to pearl millet varieties recorded highest grain and stover yields over 100 % RDN. The sowing of BAIF Bajra-1 fetched highest net monetary return (Rs.25135/ha) and benefit cost ratio (2.15) on mean basis. With respect to cutting management practices, on mean basis cutting of dual purpose pearl millet varieties at 50 DAS and left for grain fetched highest net monetary return (Rs 24081/ha) over rest of the cutting management practices. On mean basis as well as location wise, application of 150% of recommended dose of nitrogen realized highest net monetary return (Rs. 24153/ha) and benefit cost ratio (2.10) over its lower level of 100% of RDN (Table 3e). Planting of different varieties did not affect the available N in soil after harvest of the crop at Dharwad, whereas, higher level of available P in soil was observed under AVKB-19 variety. Highest available K in soil and N uptake by crop was recorded under BAIF Bajra-1. With respect to cutting management practices, higher level of available N, P and K in soil was observed when pearl millet varieties were grown without cutting. Total N uptake by crop was recorded highest with varieties cut at 50 DAS and left for grain over rest of the cutting management practices. Application of 150 % of RDN recorded highest level of available N and K in soil and total N uptake by crop over its lower level of 100 % RDN (Table -3f).

Table-3 (a): Effect of varieties, cutting management and nitrogen levels on yield of dual purpose pearl millet

Treatment	Green Forage Yield (q/ha)						Dry Matter Yield (q/ha)				
	Anand	Urulikanchan	Bikaner	Dharwad	Mandya	Mean	Anand	Bikaner	Dharwad	Mandya	Mean
A. Varieties											
BAIF Bajra-1	212.0	478.5	277.0	322.9	206.2	299.3	27.1	42.8	72.7	44.9	46.9
AVKB-19	192.0	410.4	331.4	277.2	175.9	277.4	26.1	57.4	54.9	41.9	45.1
GFB-1	223.0	385.9	397.6	242.6	183.8	286.6	33.8	71.5	50.7	45.0	50.3
SEm±	5.6	5.8	5.2	3.0	5.1		0.8	0.9	0.7	1.6	
CD at 5%	16.1	15.8	15.0	8.8	14.8		2.2	2.6	2.0	NS	
B. Cutting management											
No cutting	-	-	-	0.0	0.0	0.0	-	-	0.0	0.0	0.0
First cut at 50 DAS & leave for grain	235.0	281.1	411.8	229.8	280.4	287.6	29.3	70.4	50.5	65.4	53.9
First cut at 50 DAS & 2nd cut at 40 days after 1st cut and leave for grain	392.0	568.7	594.3	332.1	285.6	434.5	57.7	101.4	68.4	66.5	73.5
SEm±	5.6	4.7	5.2	3.0	5.1		0.8	0.9	0.7	1.6	
CD at 5%	16.1	12.9	15.0	8.8	14.8		2.2	2.6	2.0	4.6	
C. Nitrogen levels											
100% of RDN	197.0	402.5	310.6	269.9	163.4	268.7	26.9	54.2	58.0	34.9	43.5
150% of RDN	221.0	447.3	360.1	291.9	214.0	306.9	31.1	60.3	60.8	53.0	51.3
SEm±	4.6	4.7	4.3	2.5	4.2		0.6	0.7	0.6	1.3	
CD at 5%	13.2	12.9	12.3	7.1	12.1		1.8	2.1	1.7	3.8	
D. Interaction Variety X Nitrogen levels											
SEm±											
CD at 5%	NS	NS					NS				
CV%	11.4	18.6					11.3				

Table-3 (b): Effect of varieties, cutting management and nitrogen levels on grain and stover yield of dual purpose pearlmillet

Treatment	Grain yield (q/ha)						Stover yield (q/ha)					
	Anand	Urulika-nchan	Bika-ner	Dhar-wad	Man-dya	Mean	Urulika-nchan	Bika-ner	Dhar-wad	Man-dya	Anand	Mean
A. Varieties												
BAIF Bajra-1	5.65	9.5	11.9	6.0	8.0	8.2	177.4	94.9	56.3	103.0	120.3	110.4
AVKB-19	4.33	7.5	16.6	5.5	5.8	7.9	116.1	67.0	47.7	54.7	80.9	73.3
GFB-1	6.22	8.4	20.5	5.4	7.7	9.6	112.2	88.4	51.2	83.5	100.4	87.1
SEm±	0.17	0.07	0.5	0.08	0.3		1.6	1.9	1.1	3.0	3.7	
CD at 5%	0.50	0.19	1.5	0.24	0.8		4.5	5.4	3.0	8.7	10.5	
B. Cutting management												
No cutting	10.01	14.7	26.5	8.5	12.4	14.4	226.3	155.4	78.0	135.9	155.3	150.2
First cut at 50 DAS & leave for grain	5.30	8.2	17.7	5.8	6.5	8.7	98.3	66.6	57.4	68.4	117.6	81.7
First cut at 50 DAS & 2nd cut at 40 days after 1st cut and leave for grain	0.90	2.4	4.8	2.5	3.6	3.1	81.0	28.3	19.9	36.9	28.7	39.0
SEm±	0.17	0.07	0.5	0.08	0.3		1.6	1.9	1.1	3.0	3.7	
CD at 5%	0.50	0.19	1.5	0.24	0.8		4.5	5.4	3.0	8.7	10.5	
C. Nitrogen levels												
100% of RDN	4.94	8.2	15.4	5.4	5.8	7.9	128.0	79.4	51.0	64.0	91.2	82.7
150% of RDN	5.87	8.7	17.2	5.8	8.5	9.2	142.4	87.4	52.5	96.8	109.9	97.8
SEm±	0.14	0.06	0.4	0.07	0.2		1.3	1.5	0.9	2.5	2.9	
CD at 5%	0.41	0.16	1.2	0.20	0.7		3.6	4.4	NS	7.1	8.6	
D. Interaction Variety X Nitrogen levels												
SEm±												
CD at 5%		NS					NS				NS	
CV%		17.6					16.7				15.45	

Table-3(c): Growth parameters of dual purpose pearl millet varieties as influenced by different cutting management practices and nitrogen levels

Treatment	Plant height (cm)					Number of tillers/ m row length					Leaf Stem Ratio			
	Anand	Bika-ner	Dhar-wad	Man-dya	Mean	Anand	Bika-ner	Dhar-wad	Man-dya	Mean	Dhar-wad	Bika-ner	Man-dya	Mean
A. Varieties														
BAIF Bajra-1	182.4	137.7	183.1	171.4	168.7	19.9	29.8	17.8	43.1	27.7	0.41	1.76	0.31	0.83
AVKB-19	171.6	186.7	169.9	174.5	175.7	18.9	33.9	17.7	42.1	28.2	0.40	3.97	0.33	1.57
GFB-1	178.9	178.3	172.1	176.1	176.4	20.9	42.2	17.3	41.8	30.6	0.39	3.53	0.33	1.42
SEm±	3.0	2.8	1.4	1.9		0.45	0.44	0.46	0.80		0.01	0.10	0.005	
CD at 5%	8.5	8.0	4.1	NS		1.29	1.27	NS	NS		NS	0.29	0.01	
B. Cutting management														
No cutting	196.3	166.9	225.4	178.5	191.8	24.0	35.5	19.6	43.0	30.5	0.42	-	0.34	0.38
First cut at 50 DAS & leave for grain	181.2	169.0	159.5	170.8	170.1	20.3	34.9	17.8	41.4	28.6	0.40	4.64	0.30	1.78
First cut at 50 DAS & 2nd cut at 40 days after 1st cut and leave for grain	155.4	166.8	140.1	172.9	158.8	15.4	35.6	15.3	42.6	27.2	0.38	4.62	0.32	1.77
SEm±	3.0	2.8	1.4	1.9		0.45	0.44	0.46	0.80		0.01	0.10	0.005	
CD at 5%	8.5	NS	4.1	5.3		1.29	NS	1.32	NS		0.02	NS	0.01	
C. Nitrogen levels														
100% of RDN	174.3	162.4	169.2	158.6	166.1	18.5	34.1	16.41	35.8	26.2	0.38	2.96	0.28	1.21
150% of RDN	180.9	172.7	180.9	189.4	181.0	21.3	36.6	18.74	48.7	31.3	0.42	3.21	0.37	1.33
SEm±	2.41	2.3	1.2	1.5		0.37	0.36	0.38	0.65		0.01	0.08	0.004	
CD at 5%	NS	6.5	3.3	4.4		1.06	1.03	1.08	1.89		0.02	0.23	0.01	
D. Interaction Variety X Nitrogen levels														
SEm±														
CD at 5%	NS					NS								
CV%	7.1					9.61								

Table-3 (d): Economics of dual purpose pearl millet varieties as influenced by different cutting management practices and nitrogen levels

Treatment	CP (%)			Crude protein Yield (q/ha)			
	Bikaner	Dharwad	Mean	Anand	Bikaner	Dharwad	Mean
A. Varieties							
BAIF Bajra-1	7.88	6.03	7.00	3.39	10.64	6.67	6.90
AVKB-19	6.52	5.88	6.20	3.39	7.87	5.26	5.51
GFB-1	6.80	5.78	6.29	4.14	10.88	5.22	6.75
SEm±	0.04	0.03		0.09	0.13	0.08	
CD at 5%	0.11	0.09		0.27	0.38	0.24	
B. Cutting management							
No cutting	4.38	6.07	5.23	-	6.94	4.74	5.84
First cut at 50 DAS & leave for grain	8.43	6.00	7.22	4.35	11.58	6.78	7.57
First cut at 50 DAS & 2nd cut at 40 days after 1st cut and leave for grain	8.39	5.61		6.58	10.86	5.64	7.69
SEm±	0.04	0.03		0.09	0.13	0.08	
CD at 5%	0.11	0.09		0.27	0.38	0.24	
C. Nitrogen levels							
100% of RDN	6.57	5.82	6.10	3.47	8.56	5.57	5.87
150% of RDN	7.56	5.96	6.76	3.81	11.03	5.87	6.90
SEm±	0.03	0.02		0.07	0.11	0.07	
CD at 5%	0.09	0.07		0.23	0.31	0.20	
D. Interaction Entry X Nitrogen levels							
SEm±							
CD at 5%				NS			
CV%				11.32			

Table-3(e): Economics of dual purpose pearl millet varieties as influenced by different cutting management practices and nitrogen levels

Treatment	Net monetary return (Rs./ha)						Benefit cost ratio					
	Anand	Urulika-nchan	Bika-ner	Dhar-wad	Man-dya	Mean	Anand	Urulika-nchan	Bika-ner	Dhar-wad	Man-dya	Mean
A. Varieties												
BAIF Bajra-1	27863	29154	16118	23454	29087	25135	1.38	1.56	1.22	2.45	4.13	2.15
AVKB-19	17907	13961	20876	19233	18531	18101	0.89	1.24	1.59	2.02	3.00	1.75
GFB-1	26869	12802	29479	18232	24351	22347	1.33	1.23	2.24	1.93	3.68	2.08
B. Cutting management												
No cutting	21977	6944	36803	20769	10597	19418	1.31	1.22	2.80	2.63	2.34	2.06
First cut at 50 DAS & leave for grain	29180	12356	23581	24069	31218	24081	1.45	1.23	1.79	2.43	4.45	2.27
First cut at 50 DAS & 2nd cut at 40 days after 1st cut and leave for grain	21499	36617	6089	16082	30155	22088	0.92	1.58	0.46	1.35	4.00	1.66
C. Nitrogen levels												
100% of RDN	21218	15052	20432	19511	21647	19572	1.07	1.27	1.57	2.10	3.42	1.89
150% of RDN	27223	22227	23883	21102	26333	24153	1.33	1.41	1.80	2.17	3.78	2.10

Table-3(f): Effect of varieties, cutting management and nitrogen levels on soil fertility at Dharwad

Treatment	Soil fertility after harvest			Total N uptake by crop (kg/ha)
	Available N kg/ha	Available P kg/ha	Available K kg/ha	
A. Varieties				
BAIF Bajra-1	295.89	8.74	176.67	123.61
AVKB-19	293.44	8.90	172.17	98.36
GFB-1	295.17	8.88	170.06	97.71
SEm±	1.28	0.03	0.61	1.42
CD at 5%	NS	0.10	1.77	4.07
B. Cutting management				
No cutting	300.22	8.90	175.67	94.33
First cut at 50 DAS & leave for grain	293.78	8.85	172.89	124.95
First cut at 50 DAS & 2nd cut at 40 days after 1st cut and leave for grain	290.50	8.77	170.33	100.40
SEm±	1.28	0.03	0.61	1.42
CD at 5%	3.67	0.10	1.77	4.07
C. Nitrogen levels				
100% of RDN	293.19	8.94	174.41	103.63
150% of RDN	296.48	8.74	171.52	109.49
SEm±	1.04	0.03	0.50	1.16
CD at 5%	3.00	0.08	1.44	3.32

AST-4: Effect of nutrient management on productivity of perennial grasses under lowland condition

[Table Reference: 4 (a) to 4 (c)]

Location: Bhubaneswar, Jorhat, Jabalpur, Kalyani, and Ranchi

A field experiment was started during *Kharif* 2012 (establishment year) at three locations to evaluate the performance of lowland grasses in relation to crop establishment, forage productivity and nutrient management. The treatments consisted of three grasses (Para grass, koronga dol (*Saciolapsis interupta*) and local dol (*Hymanchne emplexicalis*) at Jorhat; para grass (*Brachiaria mutica*), humidicola grass (*Brachiaria humidicola*) and dol grass (*Hymanchne emplexicalis*) at Bhubaneswar and para, humidicola and guinea grass at Jabalpur), and four nutrient management practices (M1- 100 % NPK through inorganic fertilizer; M2- 50 % NPK through inorganic fertilizer + FYM @ 5t/ha; M3- FYM @5t/ha and M4- farmer practice (without nutrient) laid out in factorial RBD and replicated three times.

Due to continuous rains this trial could not be conducted at Kalyani and Ranchi centres.

At Jorhat (table 4a), significantly higher green fodder and dry matter yield was observed with para grass over koronga dol and local dol. All the nutrient management practices resulted in significantly higher GFY over the farmerôs practice. However, highest GFY was obtained with 10t/ha FYM but remained at par with application of 50% NPK (inorganic fert) +FYM 5t/ha. The application of 100% NPK (inorganic fertilizer), 50% NPK (inorganic fert) + FYM 5t/ha and FYM 10t/ha increased the green fodder yield by 51.6, 70.0 and 71.4%, respectively, over farmerôs practice. The corresponding values for DMY were 51.7, 70.0 and 71.4% higher respectively. The data on interaction between grasses and nutrient management practices are presented in Table 4(a-1). The para grass with 50% NPK (inorganic fert) +FYM 5t/ha gave significantly higher GFY (835 q/ha) over all other combinations. Similar to GFY, significantly highest DMY (179.9 q/ha) was also observed with para grass after putting 50% NPK (inorganic fert) +FYM 5t/ha.

Among the grasses, significantly higher CPY (9.4 q/ha) was recorded in para grass over the other two grasses (koronga dol and local dol). The highest CPY (9.6 q/ha) was obtained with application of 50% NPK (inorganic fert) +FYM 5t/ha. The significantly higher values of plant height and tiller/tussock were recorded in para grass as compared to other two grasses. Application of FYM @ 10 t/ha resulted in tallest plant, however, it remained at par with other nutrient management practices and significantly superior over the farmerôs practice. Similarly, all the nutrient management practices resulted in higher number of tillers/ tussock over the farmerôs practices.

At Bhubaneswar, para grass produced highest GFY (438.8 q/ha) followed by Humidicola grass (Table 4b). Similar trend has been realized in DMY. Among the nutrient management practices, 100% NPK (inorganic fertilizer) resulted in significantly higher green fodder production as compared to other treatments. However, all the nutrient management practices gave statistically higher GFY over the farmerôs practices. The application of 100% NPK (inorganic fertilizer), 50% NPK (inorganic fert) + FYM 5t/ha and FYM 10t/ha increased GFY by 85.5, 66.3 and 25.9%, respectively, over farmerôs practice. The corresponding values for DMY were 73.5, 67.9 and 20.9%, higher respectively.

Data on interaction effect of nutrient management and grasses on green fodder and dry matter yield are presented in Table 4b-1. The planting of para grass with 100% NPK (inorganic fertilizer) resulted in significantly higher GFY as compared to all other combinations except para grass with 50% NPK through inorganic fertilizer + FYM @ 5 t/ha. Similar trend as in GFY was also observed with DMY (q/ha).

The para grass yielded significantly higher crude protein (1.5 q/ha) than Humidicola grass and dol grass. Among the nutrient management practices, 100% NPK (inorganic fertilizer) and 50% NPK through inorganic fertilizer + FYM @ 5 t/ha equally resulted in higher CPY over the remaining treatments. Unlike CPY, crude protein content was recorded higher in Humidicola grass and Dol grass. The highest economic returns and BC ratio were obtained with para grass (Rs. 25071/ha and 1.68). With respect to nutrient management practices, application of 100 % NPK through inorganic fertilizer fetched highest net returns (Rs. 18035/ha) and benefit cost ratio (1.21) over rest of the treatments.

The same study at Jabalpur revealed that para grass resulted in significantly higher green fodder (316.7 q/ha) and dry matter (37.8 q/ha) yields over the other two grasses (Humidicola grass and Guinea grass). Among

the nutrient management practices, 100% NPK (inorganic fertilizer) gave highest green fodder and dry matter yield but remained at par with other nutrient management practices.

Data pertaining to interaction effect of grasses and nutrient management practices on green fodder and dry matter yields are presented in Table 4c-1. The para grass with 100% NPK (inorganic fertilizer) and 50% NPK through inorganic fertilizer + FYM @ 5 t/ha gave higher GFY as compared to other combinations. But, significantly highest DMY (56.2 q/ha) was recorded in para grass with 100% NPK (inorganic fertilizer).

The crude protein yield was found significantly higher with para grass over the other two grasses. With respect to nutrient management practices, application of 100 % NPK through inorganic fertilizers being at par with 50 % NPK through inorganic fertilizer + FYM @ 5 t/ha and FYM @ 10 t/ha recorded significantly highest CPY (1.92 q/ha) over farmerôs practice. No significant differences were observed in crude protein content (%) amongst all the nutrient management practices. Among the grasses, highest crude protein content (4.49%) was observed in Humidicola grass. The highest monetary benefit was obtained with para grass (Rs. 20973/ha) among the grasses and with 100% NPK (inorganic fertilizer) among the nutrient management practices.

Table-4 (a): Effect of nutrient management on productivity of perennial grasses under low land conditions at Jorhat

Treatments	Green fodder yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)	Plant height (cm)	Tiller/tussock
A. Grasses					
G1: Para grass	692.1	149.1	9.4	174.0	27.9
G2: Koronga Dol (*Saciolapsis interupta*)	535.3	115.3	7.1	78.6	21.8
G3: Local Dol (*Hymanchne emplexicalis*)	586.3	126.3	7.6	124.8	20.2
SEm±	5.0	1.1	0.07	2.3	0.4
CD at 5%	16.7	3.6	0.24	7.6	1.4
B. Nutrient Management					
M1: 100 % NPK (inorganic fertilizer)	618.3	133.2	8.6	131.1	26.4
M2: 50 % NPK (inorganic fert) +FYM 5t/ha	693.2	149.3	9.6	137.9	25.7
M3: FYM 10t/ha	698.9	150.5	8.9	138.5	24.7
M4: Farmer's practice (No nutrient)	407.8	87.8	5.1	95.8	16.3
SEm±	5.7	1.2	0.08	2.6	0.5
CD at 5%	19.3	4.1	0.27	8.7	1.6
C. Interaction: Grasses X Nutrient Management					
SEm±	9.9	2.1	0.14	4.5	0.9
CD at 5%	33.5	7.2	0.47	15.2	2.9
CV%	12.9	12.9	3.1	6.2	6.4

Table-4 (a-1): Interaction effect of nutrient management and grasses on green fodder and dry matter yields of forages under low land conditions at Jorhat

Entries	Green fodder yield (q/ha)					Dry matter yield (q/ha)				
	M1	**M2**	**M3**	**M4**	**Mean**	**M1**	**M2**	**M3**	**M4**	**Mean**
G1	680.7	835.0	776.0	476.7	692.1	146.6	179.9	167.2	102.7	149.1
G2	577.0	600.7	630.0	333.3	535.3	124.3	129.4	135.7	71.8	115.3
G3	597.3	644.0	690.7	413.3	586.3	128.7	138.7	148.8	89.0	126.3
Mean	**618.3**	**693.2**	**698.9**	**407.8**		**133.2**	**149.3**	**150.5**	**87.8**	
	M	**G**	**M X G**				**M**	**G**	**M X G**	
SEM±	5.74	4.97	9.94			**SEM±**	1.23	1.07	2.14	
CD at 5%	19.33	16.74	33.48			**CD at 5%**	4.16	3.60	7.21	
CV (%)	12.85					**CV(%)**	12.85			

Table-4 (b): Effect of nutrient management on productivity of perennial grasses under low land conditions at Bhubaneswar

Treatments	Green fodder yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)	Crude protein (%)	Net returns (Rs.)	Benefit cost ratio
A. Grasses						
G1: Para grass (*Brachiaria mutica*)	438.8	58.3	1.5	2.5	25071	1.68
G2: Humidicola grass (*Brachiaria humidicola*)	272.9	40.5	1.3	3.2	13316	0.89
G3: Dol grass (*Hymanchne emplexicalis*)	156.7	25.2	0.9	3.2	1653	0.11
SEm±	6.4	1.7	0.05	0.04	638	0.04
CD at 5%	18.7	4.9	0.15	0.11	1872	0.13
B. Nutrient Management						
M1: 100% NPK (inorganic fertilizer)	337.2	46.5	1.3	2.9	18035	1.21
M2: 50% NPK through inorganic fertilizer + FYM @ 5 t/ha	302.4	45.0	1.3	3.1	16266	1.09
M3: FYM @ 10 t/ha	228.8	32.4	0.9	2.9	5738	0.38
M4: Farmer's practice (No nutrient)	181.8	26.8	0.9	3.1	9149	0.61
SEm±	5.5	1.5	0.05	0.03	553	0.04
CD at 5%	16.2	4.3	0.13	0.10	1621	0.11
C. Interaction: Grasses X Nutrient Management						
SEm±	11.1	2.9	0.09	0.06	1106	0.07
CD at 5%	32.4	8.5	0.26	0.19	3242	0.22
CV%	8.6	15.8	16.9	3.91	27.0	26.9

Table-4 (b-1): Interaction effect of nutrient management and grasses on green fodder and dry matter yields of forages under low land conditions at Bhubaneswar

Entries	Green fodder yield (q/ha)					Dry matter yield (q/ha)				
	M1	**M2**	**M3**	**M4**	**Mean**	**M1**	**M2**	**M3**	**M4**	**Mean**
G1	460.8	452.2	403.2	321.7	438.8	61.2	60.1	53.6	42.8	58.3
G2	321.7	253.9	243.0	201.0	272.9	42.8	40.4	38.3	34.6	40.5
G3	229.1	201.0	40.1	22.7	156.7	35.5	34.6	5.4	3.1	25.2
Mean	**337.2**	**302.4**	**228.8**	**181.8**	**289.5**	**46.5**	**45.0**	**32.4**	**26.8**	
	M	**G**	**M X G**				**M**	**G**	**M X G**	
SEM±	6.4	5.5	11.1			**SEM±**	1.7	1.5	2.9	
CD at 5%	18.7	16.2	32.4			**CD at 5%**	4.9	4.3	8.5	
CV (%)	8.6					**CV (%)**	15.8			

Table-4 (c): Effect of nutrient management on productivity of perennial grasses under low land conditions at Jabalpur

Treatments	Green fodder yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)	Crude protein (%)	Net monetary Returns (Rs./ha)
A. Grasses					
G1: Para grass (*Brachiaria mutica*)	316.7	37.8	2.3	4.02	20973
G2: Humidicola grass (*Brachiaria humidicola*)	126.1	20.5	1.9	4.49	10153
G3: Guinea grass	42.7	23.1	1.1	3.68	(-) 3680
SEm±	10.1	2.1	0.1	0.1	55.0
CD at 5%	45.4	6.4	0.2	0.3	165.0
B Nutrient Management					
M1: 100 % NPK (inorganic fertilizer)	231.6	37.5	1.9	3.78	11915
M2: 50% NPK through inorganic fertilizer + FYM @ 5t/ha	222.4	36.1	1.9	3.79	7105
M3: FYM @ 10t/ha	199.9	32.8	1.9	3.86	287
M4: Farmer practice (no nutrient)	161.8	27.1	1.8	4.06	9149
SEm±	12.1	1.1	0.04	0.1	48.0
CD at 5%	36.3	3.3	0.12	NS	144.0
C. Interaction: Grasses X Nutrient Management					
SEm±	4.0	0.24	0.07	0.1	27.0
CD at 5%	12.0	0.72	0.21	0.2	81.0
CV%	12.0	8.0	3.40	3.0	14.0

Table-4 (c-1): Interaction effect of nutrient management and grasses on green fodder and dry matter yields of forages under low land conditions at Jabalpur

Entries	Green fodder yield (q/ha)					Dry matter yield (q/ha)				
	M1	**M2**	**M3**	**M4**	**Mean**	**M1**	**M2**	**M3**	**M4**	**Mean**
G1	455.8	447.2	398.2	316.7	316.7	56.2	55.1	48.6	37.8	37.8
G2	178.9	168.0	154.1	126.1	126.1	30.9	28.7	26.0	20.5	20.5
G3	60.1	52.1	47.3	42.7	42.7	25.4	24.3	23.7	23.1	23.1
Mean	**231.6**	**222.4**	**199.9**	**161.8**		**37.5**	**36.1**	**32.8**	**27.1**	
	M	**G**	**M X G**				**M**	**G**	**M X G**	
SEM±	10.12	12.11	4.01			**SEM±**	2.12	1.11	0.24	
CD at 5%	45.36	36.33	12.03			**CD at 5%**	6.36	3.33	0.72	
CV (%)	12.00					**CV (%)**	8.0			

AST-5: Effect of stubble management and INM on forage productivity in rice- oat cropping system

Location: Jorhat and Bhubaneswar

This was the second year of experimentation at Jorhat (first year at Bhubaneswar) to study the effect of different cutting height of rice stubble and INM on crop establishment and forage productivity of oat. The result of the complete sequence will be reported in annual report of Rabi 2013-14.

AST-6 (NT): Study on different models for year round green fodder production under irrigated condition

Location: Anand, Urulikanchan, Bikaner and Rahuri

This was the first year of experimentation to study the different combinations of perennial and seasonal fodder crops for productivity and to identify suitable crop combinations. After completion of the sequence, result will be reported in annual report of Rabi 2013-14.

AST-7 (NT): Evaluation of fodder crops under different rice fallow system

Location: Ranchi, Jabalpur and Bhubaneswar

This experiment was started in Kharif 2013 at three locations to assess the impact of different methods of rice cultivation on establishment, yield and economics of fodder crops. After completion of the cropping sequence, results of first year experimentation will be reported in annual report of Rabi 2013-14.

AST-8 (NT): Effect of straw mulch on the water requirement, weeds and productivity of BN hybrid

Location: Ludhiana, Hisar, Bikaner and Raipur

A new experiment will be started in summer, 2014 with a view to study the effect of mulch and irrigation on water requirement, weed density and productivity of BN hybrid. Results of first year experimentation will be reported in annual report of Kharif, 2015.

AST-9 (NT): Evaluation of different varieties of grass pea (*Lathyrus sativus* L.) as forage crop under different sowing methods in rice based cropping system

Location: Raipur and Jorhat

This experiment was started in Kharif 2013 at two locations to compare the biomass and grain yield production among different varieties of grasspea under different sowing methods. After completion of the cropping sequence, data of first year experimentation will be reported in annual report of Rabi 2013-14.

B. LOCATION SPECIFIC TRIALS

AST-10: Optimization of nitrogen for maize in different forage based cropping systems
Location: Shillong

A new field experiment was started in *kharif* 2011 to study on optimization of nitrogen for maize in different forage based cropping systems. The result of the complete sequence of first year has been reported in annual report of Rabi 2011-12. This experiment could not be conducted during 2012-13 and 2013-14.

AST-11: Effect of soil amendments on productivity of rice-berseem and changes in soil properties of sodic soils
Location: Faizabad

This was the fifth year of experimentation at Faizabad to study the effect of soil amendments on productivity of rice-berseem and changes in soil properties of sodic soil. After completion of cropping sequence, data of fifth year will be reported in annual report of Rabi 2013-14.

AST -12: Effect of levels of nitrogen on productivity of perennial grass with and without tree shade
Location: Jorhat

[Table Reference: 12 (a) to 12 (b)]

A field experiment was conducted by growing two perennial grasses Setaria (*Setaria anceps*) and Congo signal (*Brachiaria brizantha*) under open condition and under the trees of *Machillus bombycini* with three levels of N in split plot design replicated thrice. Treatment combinations comprising of shade levels (under tree shade and under open condition); perennial grasses (Setaria and Congosignal) and nitrogen levels (three levels).The grasses were planted during the month of August, 2011 and the study was carried out to find the effect of levels of nitrogen on productivity of perennial grasses with and without tree shade. The treatment in the main plots comprised of tree shade and open condition. In the sub plot, six treatment combinations consisting of two perennial grasses (Setaria and Congo signal) and three levels of nitrogen (<25% RDNF, RDNF and >25% RDNF). RDNF stands for recommended dose of nitrogenous fertilizer along with common recommended fertilizer dose for phosphorus and potash to all the treatments. The data of second year experimentation has been presented in Tables 12a to 12b.

Perennial grasses yielded 79% higher green and 80% higher dry matter under open condition than under shade (Table 12a). Congo-signal resulted in significantly higher GFY than Setaria. However, in respect of DMY, Congosignal grass did not differ significantly with that of Setaria. It was revealed that with increasing levels of nitrogen, GFY increased significantly under both the conditions. CPY found to be highest in the treatment receiving 25 per cent > RDNF which was found to be significantly superior over RDNF, 25 per cent < RDNF. Each increment of N produced significant increase in crude protein yield over the lower increment. Application of 25 per cent > RDNF to grasses fetched significantly highest NMR (Rs. 97462/ha) over < 25 % of RDNF. However it remained at par with RDNF.

Interaction effect between shade x perennial grass and shade x nitrogen levels were found to be significant in respect of total green forage yield, dry matter yield, total crude protein yield and net monetary return (Table 12b). The highest total green forage yield of 1235.6 q/ha/year was obtained under open condition in Congosignal grass. Similar effect was observed in respect of dry matter and crude protein yield being higher values recorded in Congosignal grass under these parameters. The highest net monetary return was recorded under open condition (Rs 116220/ha). On the other hand Congosignal grass recorded higher net monetary return than Setaria. There was increase in net monetary return along with increase in N levels and the highest being observed in 25%> RDNF.

Table-12 (a): Effect of levels of nitrogen on productivity of perennial grasses with and without tree shade at Jorhat

Treatment	Green fodder yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)	Plant height (Third cut) (cm)	Tiller/tussock (Third cut)	Net monetary return (Rs/ha)
A. Growing condition						
Under tree shade	689.2	144.7	10.6	176.2	59.3	62317
Open condition	1235.6	259.4	18.0	164.1	90.1	116220
SEm±	30.4	6.3	0.2	2.4	7.7	4428
CD at 5%	93.3	19.7	7.6	7.6	23.8	13653
B. Grasses						
Setaria anceps	944.7	198.3	13.7	172.6	55.4	87567
Brachiaria brizantha	980.11	205.2	14.8	167.8	94.1	90970
SEm±	30.4	6.3	0.2	7.7	7.7	4428
CD at 5%	93.3	19.7	7.6	2.6	22.5	13653
C. Nitrogen levels					23.8	
25%< RDNF	852.3	179.0	12.4	164.4	69.8	78550
RDNF	988.4	207.6	14.7	170.6	74.5	91793
25%> RDNF	1046.6	219.8	15.7	175.5	80.0	97462
SEm±	37.3	7.8	0.2	3.0	9.4	5423
CD at 5%	115.0	24.1	0.7	9.3	29.2	16721
D. Interaction						
S X P						
SEm±	52.7	11.0	0.3	4.3	13.3	7670
CD at 5%	155.2	32.9	0.9	12.6	NS	16721
S X N						
SEm±	64.6	13.5	0.4	5.2	16.4	9394
CD at 5%	217.5	45.5	1.4	17.7	NS	31620
CV%	13.6	16.7	17.4	6.2	14.3	21.0

Table-12 (b): Interaction effect of levels of nitrogen, grasses and growing conditions on productivity of perennial grasses

Treatment	Green fodder yield (q/ha)			Dry matter yield (q/ha)			Crude protein yield (q/ha)		
A. Growing condition	**Under tree shade**	**Open condition**	**Mean**	**Under tree shade**	**Open condition**	**Mean**	**Under tree shade**	**Open condition**	**Mean**
25%< RDNF	633.2	1071.3	852.3	133.0	225.0	179.0	9.8	15.0	12.4
RDNF	691.5	1285.3	988.4	145.2	269.9	207.6	10.7	18.8	14.8
25%> RDNF	743.0	1350.2	1046.6	156.0	283.5	219.8	11.4	20.1	15.8
Mean	**689.2**	**1235.6**		**144.7**	**259.5**		**10.6**	**18.0**	
SEm±	64.6			13.5			1.2		
CD at 5%	217.5			45.6			4.0		
B. Grasses									
Setaria anceps	683.9	1205.5	944.7	143.6	253.1	166.8	10.3	17.2	13.7
Brachiaria brizantha	694.6	1265.6	980.1	145.9	265.8	172.6	10.9	18.7	14.8
Mean	**689.2**	**1235.6**		**144.7**	**259.5**		**10.6**	**18.0**	
SEm±	52.7			11.0			0.9		
CD at 5%	155.2			32.6			2.9		

AST–13: Effect of time of sowing and seed rate on performance of fodder maize (*Zea mays*) under rainfed condition [Table Reference: 13 (a) to 13 (a-1)]

Location: Imphal

A new field experiment was initiated in *kharif* 2012 at Imphal to study the effect of time of sowing and seed rate on performance of fodder maize (*Zea mays*) under rainfed condition.. The experiment was laid out in FRBD with three replications and nine treatments. The treatments consisted of three different date of sowing (26th May, 4th June and 14th June) and seed rate (40 kg/ha, 60 kg/ha and 80 kg/ha); and the combination of both. The data of second year experimentation is presented below.

The results revealed that there was significant effect of time of sowing and seed rate on green fodder yield (q/ha), crude protein yield (q/ha), dry matter yield (q/ha) and plant height (cm). Among different date of sowing, maize sown on 26th May produced significantly highest green fodder yield (505.2q/ha), DMY (161.2q/ha), CPY (15.4 q/ha), plant height (263.9 cm), NMR (Rs. 59607/ha) and benefit cost ratio (3.69) over rest of the dates of sowing. With respect to seed rate, maize sown at seed rate of 80 kg/ha recorded maximum green fodder yield (417.5 q/ha) and net monetary returns (Rs.45780/ha). However, maximum DMY and CPY was recorded when maize was sown with seed rate of 40 kg/ha.

With respect to interaction effect among different date of sowing and seed rate, maize sown on 26th May with a seed rate of 60kg/ha produced highest green fodder yield (546.6 q/ha) and net returns (Rs 65812/ha) over rest of the combinations.

Table-13 (a): Effect of time of sowing and seed rate on performance of fodder maize (*Zea mays* L.) under rainfed condition at Imphal

Treatment	GFY (q/ha)	DMY (q/ha)	CPY (q/ha)	Crude protein (%)	Plant height (cm)	Leaf stem ratio	Net return (Rs./ha)	Benefit cost ratio
A. Date of sowing								
D_1: 26th May	505.18	161.21	15.35	9.41	263.95	0.70	59607	3.69
D_2: 4th June	376.78	118.58	11.66	9.70	236.82	0.58	39681	2.36
D_3: 14th June	349.78	79.88	6.29	8.05	224.56	0.71	34964	2.00
SEm±	3.13	4.00	0.77	0.59	1.55	0.05	469	0.03
CD at 5%	9.38	11.98	2.31	NS	4.63	NS	1407	0.08
B. Seed rate(kg/ha)								
S_1: 40	410.00	139.11	14.83	10.19	247.80	0.62	44664	2.67
S_2: 60	404.29	126.42	10.45	8.30	243.80	0.63	43808	2.63
S_3: 80	417.45	94.15	8.03	8.67	233.73	0.75	45780	2.74
SEm±	3.13	4.00	0.77	0.59	1.55	0.05	469	0.03
CD at 5%	9.38	11.98	2.31	NS	4.63	NS	1407	0.08
C. Interaction: D x S								
SEm±	5.96	6.92	1.33	1.02	2.68	0.09	813	0.05
CD at 5%	17.86	20.75	4.00	NS	8.03	NS	2437	0.14

Table-13 (a-1): Interaction of effect of time of sowing and seed rate on green fodder yield and net return of fodder maize (*Zea mays* L.) under rainfed condition at Imphal

Treatment	Green fodder yield (q/ha)				Net return (Rs./ha)			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	480.3	546.6	488.7	505.2	55880	65812	57130	59607
D_2	392.3	326.0	412.0	376.8	42014	32064	44964	39681
D_3	357.3	340.3	351.7	349.8	36097	33547	35247	34964
Mean	410.0	404.3	417.5		44664	43808	45780	
	Date of sowing	**Seed rate**	**Date of sowing x Seed rate**		**Date of sowing**	**Seed rate**	**Date of sowing x Seed rate**	
SEm±	3.13	3.13	5.96		469	469	813	
CD at 5%	9.38	9.38	17.86		1407	1407	2437	

AST – 14: Performance of fodder rice bean as influenced by dates of sowing and spacing

Location: Imphal

(Table Reference: 14 (a) to 14(a-1)

This experiment was initiated in *kharif* 2012 at Central Agricultural University, Imphal to study the performance of fodder rice bean [*Vigna umbellate* (Thumb) Ohwi and Ohashi] as influenced by dates of sowing and spacing at Imphal. The study was undertaken with nine treatments and three replications. The experiment was laid out in FRBD with two factors *viz.* date of sowing (26th May, 4th June, and 14th June,) and spacing (25 cm, 35 cm and 45 cm row to row). The results of second year experimentation are given below.

Sowing of maize on 26th May produced significantly highest GFY (312.7 q/ha), DMY (63.8 q/ha), CYP (7.2 q/ha), net monetary returns (Rs. 31519/ha) and benefit cost ratio (2.05) as compared to maize sowed on 4th June and 14th June. With respect to spacing, planting of maize at the spacing of 25 cm being at par with 35 cm spacing recorded significantly higher GFY (233.1 q/ha), DMY (50.0 q/ha), NMR (Rs 19567/ha) and benefit cost ratio (1.27) over spacing of 45 cm.

The combined effect of date of sowing and spacing had significant influence on green fodder yield and net return. Sowing of rice bean on 26th May with a spacing of 25 cm produced highest GFY (321.9 q/ha) and net monetary return (Rs. 32902/ha) over rest of the combinations.

Table-14(a): Effect of date of sowing and spacing on yields, growth attributes and economics of rice bean at Imphal

Treatment	GFY (q/ha)	DMY (q/ha)	CPY (q/ha)	Crude protein (%)	Plant height (cm)	Leaf stem ratio	Net return (Rs./ha)	Benefit cost ratio
A. Date of sowing								
D_1 : 26th May	312.74	63.77	7.21	11.05	185.11	0.48	31519	2.05
D_2 : 4th June	201.21	42.77	5.16	11.84	128.49	0.70	14789	0.96
D_3 : 14th June	170.04	32.56	3.46	10.75	115.49	0.70	10114	0.66
SEm±	3.19	2.26	0.84	1.56	1.31	0.05	479	0.03
CD at 5%	9.58	6.79	2.53	NS	3.92	0.15	1436	0.09
B. Spacing (row to row)								
S_1 : 25 cm	233.06	50.04	4.92	10.05	148.09	0.55	19567	1.27
S_2 : 35 cm	230.59	45.11	5.76	12.23	135.31	0.69	19197	1.25
S_3 : 45 cm	220.33	43.95	5.16	11.36	145.69	0.64	17657	1.15
SEm±	3.19	2.26	0.84	1.56	1.31	0.05	505	0.03
CD at 5%	9.58	6.79	NS	NS	3.92	0.15	1514	0.09
C. Interaction: D X S								
SEm±	5.53	3.65	1.46	2.71	2.27	0.09	830	0.00
CD at 5%	16.59	NS	NS	NS	6.79	NS	2488	0.16

Table-14(a-1): Interaction effect of date of sowing and spacing on green fodder yield and net return of rice bean at Imphal

Treatment	Green fodder yield (q/ha)				Net return (Rs./ha)			
	S_1	S_2	S_3	Mean	S_1	S_2	S_3	Mean
D_1	302.24	321.96	314.02	312.74	29944	32902	31711	31519
D_2	222.64	197.48	183.50	201.21	18004	14230	12132	14789
D_3	174.31	172.34	163.47	170.04	10754	10459	9128	10114
Mean	233.06	230.59	220.33		19567	19197	17657	
	Date of sowing	**Spacing**	**Date of sowing x Spacing**		**Date of sowing**	**Spacing**	**Date of sowing x Spacing**	
SEm±	3.19	3.19	5.53		479	505	830	
CD at 5%	9.58	9.58	16.59		1436	1514	2488	

AST-15: Enhancing the production potential of various forage crops in coconut gardens through nutrient management [Table Reference: 15 (a) to 15 (b-2)]

Location: Mandya

The experiment was initiated during 2012 to assess the performance of different crops and nutrient levels on productivity, quality and economics of forage crops in coconut garden. The treatment consisted of three crops (C1-BN hybrid, C2-guinea and C3-signalgrass) and three levels of NPK (100% RDNF, 125% RDNF, 150% RDNF) laid out in FRBD & replicated three times. Result of first year experimentation revealed that BN hybrid recorded significantly highest GFY (384.2q/ha), DMY (86.5q/ha), net monetary returns (Rs.27271/ha) & benefit cost ratio (3.41) over guinea & signal grass. The application of 150% RDF to different crop(s) recorded highest GFY (326.7q/ha), DMY (84.8q/ha), net monetary returns (Rs.23438/ha) & benefit cost ratio (2.08). Interaction effect among the crops & nutrient levels were found significant with respect to GFY & DMY. The maximum light interception in the bottom of the canopy was observed in BN hybrid with application of 150% RDNF (25.95%), whereas, maximum light Interception at the middle of the canopy was recorded in signal grass with 150% RDNF (16.78%).

Table-15(a): Effect of crops and nutrient levels on growth attributes, yield and economics of forages under coconut gardens

Treatment	Plant height (cm)	Leaf stem ratio	GFY (q/ha)	DMY (q/ha)	NMR (Rs./ha)	Benefit cost ratio
Crops (C)						
BN hybrid	96.96	0.70	384.18	86.47	27271	3.41
Guinea grass	73.67	0.61	249.91	73.36	16122	2.73
Signal grass	39.39	0.42	131.44	34.72	7164	1.91
SEm±	1.25	0.01	7.35	2.26	--	--
CD at 5%	3.75	0.58	22.04	6.79	--	--
Nutrients level (%)						
100	58.89	0.50	177.40	42.91	9709	1.66
125	67.91	0.58	261.41	66.83	17410	1.98
150	83.23	0.64	326.70	84.81	23438	2.08
SEm±	1.25	0.01	7.35	2.26	--	--
CD at 5%	3.75	0.58	22.04	6.79	--	--
Interaction : C X N						
SEm±	2.16	0.03	12.74	3.92		
CD at 5%	6.50	NS	38.18	11.76		
CV %	5.37	10.07	8.65	10.49		

Table-15(a-1): Interaction effect of forage crops and nutrients level on green fodder yield

Green fodder yield (q/ha)				
Crops	**Nutrients level**			
	100 %	**125%**	**150 %**	**Mean**
BN hybrid	257.55	402.77	492.23	384.18
Guinea grass	180.72	262.95	306.07	249.91
Signal grass	93.94	118.52	181.86	131.44
Mean	177.40	261.42	326.72	
	Crops	**Nutrients**	**Crops X Nutrients**	
SEm±	7.35	7.35	12.74	
CD at 5%	22.04	22.04	38.18	
CV %	8.65	--	--	

Table-15(a-2): Interaction effect of forage crops and nutrients level on dry matter yield

Dry matter yield (q/ha)				
Crops	**Nutrients level**			
	100 %	**125%**	**150 %**	**Mean**
BN hybrid	54.86	92.85	111.70	86.47
Guinea grass	48.79	77.83	94.05	73.36
Signal grass	25.08	30.41	48.67	34.72
Mean	42.91	66.83	84.81	
	Crops	**Nutrients**	**Crops x Nutrients**	
SEm±	2.26	2.26	3.92	
CD at 5%	6.79	6.79	11.76	
CV %	10.49	--	--	

Table- 15 (b): Interaction effect of forage crops and nutrients level on light interception at bottom and middle of the canopy

Treatments	Bottom of the canopy		Middle of the canopy	
	Percent light availability	**Percent light Interception**	**Percent light availability**	**Percent light Interception**
BN hybrid + 100% Nutrients level	79.23	20.77	88.14	11.86
BN hybrid + 125% Nutrients level	74.87	25.13	89.57	10.43
BN hybrid + 150% Nutrients level	74.05	25.95	83.88	16.12
Guinea grass + 100% Nutrients level	78.66	21.34	87.63	12.37
Guinea grass + 125% Nutrients level	79.48	20.52	87.52	12.48
Guinea grass + 150% Nutrients level	79.80	20.20	87.94	12.06
Signal grass + 100% Nutrients level	77.14	22.86	90.30	9.70
Signal grass + 125% Nutrients level	82.33	17.67	90.82	9.18
Signal grass + 150% Nutrients level	75.70	24.30	83.22	16.78

AST-16: Cropping system studies in fodder maize with legume intercropping

[Table Reference: 16(a)]

Location: Srinagar

The experiment was conducted to evaluate the forage production potential of maize and legume intercropping in terms of total dry matter production and maize forage quality. The nine treatments consisted of sole maize (30 cm spacing), sole cowpea (30 cm spacing), sole soybean (30 cm spacing), maize + cowpea (1:1), maize + cowpea (2:1), maize + soybean (1:1), maize + soybean (2:1), maize + cowpea mixed cropping and maize + soybean mixed cropping laid out in RBD with three replications. This was the second year of the experiment.

The results revealed that GFY (480.2 q/ha) and DMY (144.3 q/ha) of sole maize was significantly higher than both sole legumes as well as different intercropping ratios. However, it (sole maize) remained at par with mixed intercropping of soybean in terms of GFY. Among the different treatments tested, sole cowpea was found to have maximum crude protein content (17.80 %) followed by sole soybean (14.20 %). It was also observed that sole maize had maximum crude protein yield (12.26 q/ha) than rest of the treatments and the minimum was found in maize + soybean (1:1) intercropping system. Highest maize fodder equivalent yield (495 q/ha) was recorded in maize + soybean mixed cropping system over rest of the treatments [Table 16(a)].

Table 16(a): Yield, growth and quality of forage crops as influenced by fodder maize with different legume intercropping system

Treatment	GFY (q/ha)	DMY (q/ha)	CPY (q/ha)	Plant Height (cm)	Crude Protein Content (%)	Maize FEY (q/ha)
Sole maize (30cm spacing)	480.18	144.32	12.26	237.78	8.5	480.00
Sole cowpea (30cm spacing)	188.13	31.96	5.68	75.74	17.8	285.00
Sole soybean (30cm spacing)	200.40	42.00	5.96	78.56	14.2	298.00
Maize + cowpea (1:1)	308.90	70.84	7.22	243.10	10.2	360.00
Maize + cowpea (2:1)	432.78	108.00	9.72	240.56	9.0	465.00
Maize + soybean (1:1)	320.00	76.80	7.98	235.18	10.4	370.00
Maize + soybean (2:1)	378.50	95.73	8.51	228.43	8.9	410.00
Maize + cowpea mixed cropping	441.18	97.02	11.93	241.60	12.3	490.00
Maize + soybean mixed cropping	450.65	112.50	13.38	245.70	11.9	495.00
SEm ±	11.34	3.40	0.40	2.13	0.52	13.19
CD at 5%	31.75	9.75	1.20	14.60	1.48	37.60

AST-17: Effect of varying seed rate of forage legumes on productivity of fodder maize

(Table Reference: 17(a))

Location: Srinagar

The experiment was started in kharif -2012 to study the effect of varying seed rate of forage legumes on productivity of fodder maize. The experiment was laid out in RBD with three replications and nine treatments. The nine treatments consisted of sole maize (30cm spacing), sole cowpea (30cm spacing), sole soybean (30cm spacing), maize + cowpea @ 20 kg/ha, maize + cowpea @ 40 kg/ha, maize + cowpea @ 60 kg/ha, maize + soybean @ 40 kg/ha, maize + soybean @ 60 kg/ha and maize + soybean @ 80 kg/ha. Being a replacement series, the seed rate of maize was adjusted as per the row proportion. This was the second year of experiment.

Sole maize recorded significantly highest GFY (490.3 q/ha) and DMY (137.2 q/ha) over rest of the intercropping systems including both sole cowpea and sole soybean. Maize + cowpea @ 60 kg/ha seed rate showed significant increase of both GFY (340.3 q/ha) and DMY (64.6 q/ha) over maize + cowpea @ 20 kg/ha seed rate but remained at par with maize + cowpea @ 40 kg/ha seed rate. Planting of maize + soybean @ 60 or 80 kg/ha recorded significantly higher GFY and DMY over maize + soybean @ 40 kg/ha seed rate. Sole cowpea recorded significantly highest crude protein content (15.9%) over rest of the treatments either sole crops or intercropping systems. Being a replacement series, the productivity of sole maize was maximum than different intercrops. [Table 17a].

Table 17(a): Yield, growth and quality as influenced with fodder maize and forage legume under varying seed rates of intercrops

Treatment	GFY (q/ha)	DMY (q/ha)	CPY (q/ha)	Plant height (cm)	Crude Protein Content (%)	Plant popula-tion / m²
Sole maize (30cm spacing)	490.32	137.20	11.52	235.56	8.4	26.33
Sole cowpea (30cm spacing)	180.25	30.60	4.86	75.90	15.9	31.22
Sole soybean (30cm spacing)	185.67	42.55	5.95	77.80	14.0	35.10
Maize + cowpea @ 20kg/ha	298.00	56.62	5.10	224.50	9.0	20.14
Maize + cowpea @ 40kg/ha	335.46	63.65	5.85	230.25	9.2	32.10
Maize + cowpea @ 60kg/ha	340.25	64.60	6.30	228.40	9.8	33.20
Maize + soybean @ 40kg/ha	270.75	60.40	5.35	226.12	8.9	22.44
Maize + soybean @ 60kg/ha	315.90	75.60	7.20	224.30	9.5	34.12
Maize + soybean @ 80kg/ha	321.60	80.25	7.80	230.60	9.7	33.70
SEm ±	3.28	2.10	0.24	3.90	0.46	1.20
CD at 5%	9.40	5.80	0.68	11.20	1.32	3.45

AST-18: Performance of Bajra Napier hybrid grass as influenced by micronutrients under irrigated conditions

Location: Coimbatore

This trial was initiated during kharif 2012 with an objective to study the conjoint application of organic manure, inorganic fertilizers and micronutrients on forage yield, economics of production and soil properties. The kharif 2012 was considered as establishment year and data of first year has been reported in annual report of Rabi 2012-13 and data of second year experimentation will be reported in annual report of Rabi 2013-14.

AST-19 (NT): Residual effect of P applied to wheat on succeeding summer fodders in sorghum-wheat-summer fodder cropping system

Location: Ludhiana

A new field experiment was started in *kharif* 2013 to identify suitable summer fodder crop in sorghum-wheat-summer fodder cropping systems and data of this experiment will be reported after completion of the sequence in annual report of Rabi 2013-14.

AST-20 (NT): Weed management in multicut sorghum

(Table Reference: 20 (a) to 20 (c))

Location: Ludhiana

The experiment was initiated during *kharif* 2013 at Ludhiana to study the effect of herbicides on the weed density, fodder yield and quality of multicut sorghum. The density of weeds was significantly higher in weedy check during all the years of study. The density of total weeds in weedy check was 227.3 weeds/m^2 which was significantly higher than the density of total weeds in herbicide treatments and hand weeding. Among the weed control treatments, the density of total weeds was significantly higher in plots where atrazine or pendimethalin alone were applied and was least in atrazine 0.375 + pendimethalin 0.75 kg/ha combination. Among the herbicide treatments, the highest weed control efficiency was noticed in propaquizalofop 0.0625 and 0.075 kg/ha closely followed by atrazine + pendimethalin combinations. Herbicides valloe, pinoxden, propaquizalofop and oxyflorfen at all the levels controlled the weeds effectively but were toxic to the crop resulting in poor fodder yield of multicut sorghum. The highest green fodder yield (905.5 q/ha) and dry matter yield (172.8 q/ha) was obtained with hand weeding which was at par with atrazine + pendimethalin combinations. Among herbicides, the highest fodder (890.8 q/ha green fodder and 170.7 q/ha dry matter) yield was observed with atrazine 0.375 kg + pendimethalin 0.75 kg a.i./ha closely followed by atrazine 0.250 + pendimethalin 0.750 kg a.i./ha. The crude protein content and production of multicut sorghum was improved in all the herbicide treatments and hand weeding than the weedy check

Table 20 (a): Effect of herbicides on fodder yield of multicut sorghum

Treatments	Green fodder yield (q/ha)				Dry matter yield (q/ha)			
	1st cut	2nd cut	3rd cut	Total	1st cut	2nd cut	3rd cut	Total
T1	348.8	239.7	170.9	759.4	65.6	47.4	33.4	146.4
T2	361.1	242.7	178.7	782.5	69.1	48.7	34.9	152.7
T3	392.4	264.8	179.5	836.7	76.0	53.6	35.7	165.3
T4	422.4	287.5	180.9	890.8	76.9	57.5	36.3	170.7
T5	239.7	211.9	160.0	611.6	44.6	41.8	32.6	119.0
T6	211.9	157.2	116.1	485.2	39.6	30.4	23.3	93.3
T7	273.4	223.5	131.3	628.2	57.9	44.7	25.9	128.5
T8	277.6	222.9	112.7	613.2	58.5	44.0	22.2	124.7
T9	201.8	216.1	124.6	542.5	41.1	42.8	25.0	108.9
T10	210.1	208.4	127.9	546.4	38.7	40.7	25.9	108.3
T11:	128.6	132.4	93.3	354.3	24.7	26.8	19.7	71.2
T12	119.7	128.8	102.7	351.2	22.9	25.6	20.4	68.9
T13	431.1	284.2	189.6	905.5	78.6	56.8	37.4	172.8
T14	304.9	210.4	138.9	654.2	55.9	41.8	27.9	125.6
S Em ±	12.54	8.38	4.67	29.15	2.21	1.58	1.12	5.09
CD at 5 %	36.8	24.6	13.7	68.9	6.49	4.63	3.29	14.9
CV %	7.09	6.29	5.88	7.33	6.55	5.96	7.18	6.71

T1: Atrazine 0.5 kg/ha PE **T2:** Pendimethalin 0.75 kg/ha PE **T3:** Atrazine 0.25 + pendi 0.75 kg/ha PE
T4: Atrazine 0.375 + pendi 0.75 kg/ha PE **T5:** Pinoxaden 0.0375 kg/ha Post-emer. **T6:** Pinoxaden 0.05 kg/ha Post-emer.
T7: Oxyflorfen 0.088 kg/ha PE **T8:** Oxyflorfen 0.146 kg/ha PE **T9:** Vallore (Imaze. + pendi) 0.560 kg/ha PE
T10: Vallore (Imaze. + pendi) 0.750 kg/ha PE **T11:** Propaquizalofop 0.0625 kg/ha Post-emer.
T12: Propaquizalofop 0.0750 kg/ha Post-emer. **T13:** Hand weeding **T14:** Control

Table 20 (b): Effect of herbicides on weed biomass, weed control efficiency (I cut) and crude protein yield of multicut sorghum

Treatments	Weed population /m²	Weed dry weight (q/ha)	Weed control efficiency (%)	CP (%)			Crude protein yield (q/ha)			
				1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut	Total
T1	8.51 (72.4)	5.58	59.3	7.36	7.52	7.68	4.83	3.56	2.57	10.96
T2	7.37 (53.3)	4.41	67.8	7.42	7.68	7.92	5.13	3.72	2.76	11.61
T3	5.30 (27.1)	1.45	89.4	7.46	7.84	8.04	5.67	4.20	2.87	12.74
T4	3.99 (14.9)	0.87	93.6	7.54	7.93	8.17	5.80	4.56	2.97	13.33
T5	5.84 (33.1)	1.82	86.7	7.42	7.88	8.26	3.31	3.29	2.69	9.29
T6	5.12 (25.2)	1.38	89.9	7.46	7.93	8.21	2.95	2.41	1.91	7.27
T7	5.69 (31.4)	1.76	87.1	7.54	7.82	8.09	4.37	3.50	2.10	9.97
T8	4.82 (22.2)	1.33	90.3	7.54	7.93	8.14	4.41	3.49	1.81	9.71
T9	5.21 (26.2)	1.51	89.0	7.46	7.82	8.21	3.07	3.35	2.05	8.47
T10	4.54 (19.7)	1.08	92.2	7.46	7.88	8.18	2.89	3.21	2.12	8.22
T11	3.36 (10.3)	0.62	95.4	7.61	7.74	8.22	1.88	2.07	1.62	5.57
T12	3.07 (8.4)	0.54	96.1	7.68	7.77	8.26	1.76	1.99	1.68	5.53
T13	3.66 (12.4)	0.76	94.5	7.62	8.02	8.26	5.98	4.56	3.09	13.63
T14	15.11 (227.3)	13.72	-	7.13	7.31	7.44	3.99	3.06	2.08	9.13
S Em ±	0.33	0.18	-	-	-	-	0.16	0.14	0.09	0.45
CD 5 %	0.96	0.54	-	-	-	-	0.46	0.42	0.28	1.32
CV %	9.07	11.28	-	-	-	-	6.28	7.09	6.87	7.53

Figures in parenthesis are the original values

Table 20(c): Effect of herbicides on plant characters of multicut sorghum

Treatments	Plant height (cm)			Tillers/m			Leaf : stem ratio		
	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
T1	160.5	154.3	137.3	49.0	18.7	29.1	0.62	0.74	0.85
T2	163.4	156.4	139.8	51.1	19.2	30.8	0.67	0.72	0.90
T3	172.9	160.5	139.6	53.3	19.9	29.9	0.69	0.77	0.90
T4	178.1	162.5	138.7	54.8	20.4	30.4	0.67	0.78	0.87
T5	128.8	104.7	94.4	32.5	12.3	21.1	0.67	0.68	0.72
T6	116.7	108.5	98.5	24.1	12.1	17.3	0.67	0.63	0.79
T7	147.1	101.3	91.4	44.7	11.9	26.8	0.64	0.65	0.73
T8	157.9	104.2	94.2	46.6	12.3	28.0	0.61	0.68	0.79
T9	125.0	118.0	98.0	27.9	12.6	17.9	0.67	0.66	0.80
T10	116.6	119.9	97.9	24.7	12.4	17.0	0.72	0.63	0.83
T11	111.6	116.7	91.3	26.6	12.6	18.3	0.74	0.65	0.76
T12	107.4	109.9	94.4	28.2	12.4	18.1	0.72	0.63	0.84
T13	168.7	164.0	140.4	55.8	21.1	29.3	0.74	0.71	0.89
T14	136.8	128.0	108.2	43.3	12.5	25.5	0.60	0.64	0.73
S Em ±	8.51	7.71	5.49	2.36	0.80	0.35	-	-	-
CD at 5 %	24.9	22.6	16.1	6.92	2.35	1.03	-	-	-
CV %	9.91	8.74	8.29	10.23	9.51	9.72	-	-	-

T1: Atrazine 0.5 kg/ha PE **T2:** Pendimethalin 0.75 kg/ha PE **T3:** Atrazine 0.25 + pendi 0.75 kg/ha PE
T4: Atrazine 0.375 + pendi 0.75 kg/ha PE **T5:** Pinoxaden 0.0375 kg/ha Post-emer. **T6:** Pinoxaden 0.05 kg/ha Post-emer.
T7: Oxyflorfen 0.088 kg/ha PE **T8:** Oxyflorfen 0.146 kg/ha PE **T9:** Vallore (Imaze. + pendi) 0.560 kg/ha PE
T10: Vallore (Imaze. + pendi) 0.750 kg/ha PE **T11:** Propaquizalofop 0.0625 kg/ha Post-emer.
T12: Propaquizalofop 0.0750 kg/ha Post-emer. **T13:** Hand weeding **T14:** Control

AST-21 (NT): Effect of herbicides on the weed control in Bajra-Napier hybrid.

(Table Reference: 21(a) to 21 (c))

Location: Ludhiana

The experiment was initiated during *kharif* 2013 at Ludhiana to study the effect of herbicides on the weed density, fodder yield and quality of Bajra-Napier hybrid. The density of weeds was significantly higher in weedy check during all the years of study. The density of total weeds in weedy check was 145.7 weeds/m^2 which was significantly higher than the density of total weeds in herbicide treatments, intercropping and hand weeding. Among the weed control treatments, the density of total weeds was significantly higher in plots where atrazine (0.5 to 1.0 kg a.i./ha) alone was applied or in intercropping maize/cowpea/pearl millet with Bajra-Napier hybrid. Among the herbicide treatments, all the combinations of atrazine + pendimethalin effectively controlled the weeds. The weed control efficiency with atrazine alone, pendimethalin alone and atrazine + pendimethalin combinations ranged between 57.0 to 62.8, 73.0 to 76.7, 86.4 to 91.6 %, respectively as compared to 82.5 % WCE in hand weeding. Fodder yield was influenced significantly with weed control treatments. The highest green fodder yield (1288.9 q/ha) and dry matter yield (223.6 q/ha) was obtained with hand weeding which was at par with atrazine + pendimethalin combinations. Among herbicides, the highest fodder (1270.7 q/ha green fodder and 220.5 q/ha dry matter) yield was observed with atrazine 0.5 kg + pendimethalin 0.560 kg a.i./ha closely followed by atrazine 0.75 + pendimethalin 0.560 kg a.i./ha. The fodder yield in intercropping was comparable with herbicide combinations. The crude protein and dry matter digestibility contents of Napier-bajra hybrid fodder were also improved in all the herbicide treatments and hand weeding than the weedy check. The crude protein content in weed control treatments ranged between 9.8 to 18.7 % as compared 9.4 % in weedy check. Similarly, dry matter digestibility ranged between 54.8 to 59.2 % than 53.3 % in weedy check. Higher B:C ratio was observed in herbicide treatments than weedy check and hand weeding. Among herbicides, B:C ratio was higher in atrazine and pendimethalin combinations than atrazine and pendimethalin alone. The highest B:C ratio was obtained with atrazine 1.0 + pendimethalin 0.75 kg a.i./ha closely followed by atrazine 0.75 + pendimethalin 0.560 and atrazine 0.5 kg + pendimethalin 0.560 kg a.i./ha. The B:C ratio in intercropping was between 0.68 to 0.76.

Table 21 (a): Effect of herbicides on the weed intensity, weed dry matter and weed control efficiency in Napier-Bajra hybrid

Treatments	Broad leaves weeds	Grassy weeds	Total weeds	Weed dry weight (q/ha)	Weed control efficiency (%)
T1	2.97 (7.8)	7.47 (54.8)	7.97 (62.6)	6.13	57.0
T2	2.85 (7.1)	7.38 (53.4)	7.84 (60.5)	5.92	58.4
T3	2.72 (6.4)	6.99 (47.8)	7.43 (54.2)	5.30	62.8
T4	5.04 (24.4)	3.99 (14.9)	6.35 (39.3)	3.85	73.0
T5	4.70 (21.1)	3.71 (12.8)	5.91 (33.9)	3.32	76.7
T6	2.93 (7.6)	3.63 (12. 2)	4.56 (19.8)	1.94	86.4
T7	2.68 (6.2)	3.58 (11.8)	4.36 (18.0)	1.76	87.7
T8	2.59 (5.7)	3.38 (10.4)	4.14 (16.1)	1.58	88.9
T9	2.35 (4.5)	3.45 (10.9)	4.04 (15.4)	1.51	89.4
T10	2.07 (3.3)	3.35 (10.2)	3.81 (13.5)	1.32	90.7
T11	1.92 (2.7)	3.26 (9.6)	3.65 (12.3)	1.20	91.6
T12	1.92 (2.7)	3.03 (8.2)	3.45 (10.9)	1.07	92.5
T13	7.23 (51.3)	9.77 (94.4)	12.1 (145.7)	14.26	-
T14	5.16 (25.6)	7.85 (60.7)	9.34 (86.3)	8.81	38.2
T15	5.67 (31.1)	8.75 (75.6)	10.38 (106.7)	9.24	35.2
T16	5.42 (28.4)	8.29 (67.7)	9.85 (96.1)	9.07	36.4
S Em ±	0.15	0.21	0.29	1.63	-
CD at 5 %	0.43	0.62	0.84	4.79	-
CV %	8.02	7.92	8.24	8.12	-

Figures in parenthesis are the original values

Table 21 (b): Effect of herbicides on the fodder yield, crude protein and economics of Bajra napier hybrid (q/ha)

Treatments	Green fodder yield (q/ha)		Dry matter yield (q/ha)		Crude protein %	Dry matter digestibility %	Economics			
	First cut	Total yield	First cut	Total yield			Total cost	Gross returns	Net profit	B:C ratio
T1	255.6	1157.2	37.2	200.8	9.8	54.8	44894	77814	32920	0.73
T2	254.4	1182.1	37.0	205.1	10.2	55.0	45094	79326	34232	0.76
T3	256.0	1187.7	37.2	206.1	10.5	55.4	45294	80250	34956	0.77
T4	256.7	1210.5	37.3	210.0	10.4	55.8	45244	80172	34928	0.77
T5	261.3	1174.1	38.0	203.7	10.3	56.4	45494	80154	34660	0.76
T6	271.1	1270.7	39.4	220.5	10.0	57.8	45644	82932	37288	0.82
T7	258.4	1263.4	37.6	219.2	10.2	56.0	45844	83442	37598	0.82
T8	245.8	1222.8	35.7	212.2	10.4	55.6	46044	83556	37512	0.81
T9	247.1	1147.6	35.9	199.1	10.2	55.8	45894	81348	35454	0.77
T10	253.6	1173.9	36.9	203.7	10.6	55.8	46094	84504	38410	0.83
T11	253.8	1143.7	36.9	198.5	10.4	56.0	46294	82440	36146	0.78
T12	253.0	1288.9	36.8	223.6	10.6	56.0	54094	87480	33386	0.62
T13	153.2	792.6	22.3	137.5	9.4	53.3	44494	64206	19712	0.44
T14	367.6	1281.3	38.9	222.3	18.7	59.2	45244	79441	34197	0.76
T15	270.3	1288.6	39.3	223.6	11.1	57.1	45994	77316	31322	0.68
T16	289.3	1303.9	42.1	226.3	10.4	55.6	44894	78234	33340	0.74
S Em ±	10.82	57.71	2.01	10.00	0.72	1.43	-	-	-	-
CD at 5 %	31.7	169.1	5.9	29.3	NS	NS	-	-	-	-
CV %	7.81	7.96	8.26	8.03	6.58	7.31				

Table 21 (c): Effect of herbicides on the plant height and tillers/plant of BN hybrid

Treatments	Plant height (cm)			Tillers/plant		
	1st cut	2nd cut	3rd cut	1st cut	2nd cut	3rd cut
T1	25.9	70.1	99.8	11.2	19.4	23.6
T2	25	78.1	101.4	12.0	20.5	23.9
T3	26.8	83	101.7	12.9	21.6	24.4
T4	26.5	81.7	100.8	16.3	19.6	24.2
T5	29.3	87.7	101.4	16.6	20.6	25.2
T6	30.2	86.3	103.6	17.0	21.6	24.4
T7	29.8	86.8	103.7	17.5	22.7	25.0
T8	29.6	87.2	105.1	18.1	23.5	26.3
T9	30.7	87.7	103.9	17.1	22.0	25.4
T10	30.6	86.3	106.5	17.8	23.4	26.1
T11	29.5	88.5	105.3	18.4	24.0	26.8
T12	29.3	101.3	104.8	18.6	23.1	26.2
T13	23.9	66.7	96.9	7.6	13.5	19.9
T14	21.7	36.2	92.7	7.6	18.0	20.9
T15	24.7	44.0	94.8	7.7	19.1	20.4
T16	26.5	49.8	98.9	7.5	17.4	21.7
S Em ±	1.54	6.66	3.74	0.90	0.94	1.06
CD at 5 %	4.51	19.5	NS	2.64	2.74	3.13
CV %	7.63	6.49	6.71	8.06	6.89	7.26

T1: Atrazine 0.5 kg a.i./ha Pre-emergence (PE)
T2: Atrazine 0.75 kg a.i./ha PE
T3: Atrazine 1.0 kg a.i./ha PE
T4: Pendimethalin 0.560 kg a.i./ha Pre-emergence
T5: Pendimethalin 0.75 kg a.i./ha Pre-emergence
T6: Atrazine 0.5 kg + Pendimethalin 0.560 kg a.i./ha PE
T7: Atrazine 0.75 kg + Pendimethalin 0.560 kg a.i./ha PE
T8: Atrazine 1.0 kg + Pendimethalin 0.560 kg a.i./ha PE
T9: Atrazine 0.5 kg + Pendimethalin 0.75 kg a.i./ha PE
T10: Atrazine 0.75 kg + Pendimethalin 0.75 kg a.i./ha PE
T11: Atrazine 1.0 kg + Pendimethalin 0.75 kg a.i./ha PE
T12: Hand Weeding (2) – 21 and 42 DAS
T13: Weedy check (control)
T14: BN hybid + cowpea
T15: BN hybid + maize
T16: BN hybid + pearl millet

C. AVT BASED TRIALS

AST-22: Effect of phosphorus levels on forage yield of promising entries of cowpea (AVT-2)

(Table Reference: 22(a) to 22(d))

Location: Mandya, Vellayani, Coimbatore, Hyderabad and Dharwad

A field trial was conducted to find out the response of promising AVT-2 entries of cowpea with supplementation of graded doses of phosphorus. The study was under taken at 5 (Mandya, Vellayani, Coimbatore, Hyderabad and Dharwad) locations with 5 entries (including 2 national and one zonal check) and 3 levels of phosphorus (30, 60 and 90 kg $P_2O_5^{-1}$).

The data presented in Tables revealed that on over all mean basis, testing entry MFC 09-1 recorded highest green fodder yield, dry fodder yield and crude protein yields over rest of the entries. None of the national or zonal checks was found superior over testing entry of MFC 09-1 for GFY, DFY and CPY. The green and dry fodder yield of MFC 09-1 ranged between 150.6 to 269.9 and 23.0 to 56.4 q ha^{-1}, respectively in the different regions. The entry MFC 09-1 resulted in 18.88, 8.52, 10.47 and 13.38 per cent increase in green fodder yield over RR-3, UPC 9202 (ZC), UPC 5286 (NC) and Bundel Lobia-1 (NC), respectively. In case of dry fodder yield entry MFC 09-1 resulted in 15.89, 8.45, 12.73 and 6.90 per cent increase in green fodder yield over RR-3, UPC 9202 (ZC), UPC 5286 (NC) and Bundel Lobia-1 (NC), respectively. The influence of phosphorus on these parameters was linear up to the highest tested rate of P application (90 kg ha^{-1}) and registered percent increase of 20.71 and 8.63 for GFY and 23.05 and 10.81 for DFY over 30 and 60 kg P_2O_5kg/ha, respectively.

Table-22(a): Effect of phosphorus levels on green fodder and dry matter yields of promising entries of cowpea (AVTC-2)

Treatment	GFY (q/ha)						DMY (q/ha)					
	Mandya	Vellayani	Coimb-atore	Hydera-bad	Dharwad	Mean	Mandya	Vellayani	Coimb-atore	Hydera-bad	Dharwad	Mean
A. Entries												
MFC 09-1	244.4	170.3	269.9	150.6	241.3	215.3	56.4	23.0	50.1	26.1	30.6	37.2
RR-3	173.7	148.1	230.5	117.0	237.4	181.3	41.6	25.5	41.4	21.6	30.2	32.1
UPC 9202 (ZC)	164.7	178.2	252.0	152.5	244.7	198.4	39.5	26.0	44.1	30.7	31.1	34.3
UPC 5286 (NC)	195.6	166.4	238.0	130.4	244.3	194.9	45.5	23.3	40.3	24.7	31.0	33.0
Bundel Lobia-1 (NC)	169.1	162.9	256.5	131.4	229.6	189.9	41.0	33.0	45.6	25.4	29.2	34.8
SEm±	4.4	3.7	6.7	6.8	2.3		1.6	4.9	1.6	1.6	0.3	
CD at 5%	12.8	10.8	19.3	19.6	6.6		4.7	14.3	4.6	4.7	0.8	
B. Phosphorus levels (P_2O_5 kg/ha)												
30	160.7	147.2	232.9	120.4	224.9	177.2	39.2	24.5	39.6	22.0	28.6	30.8
60	190.5	155.6	252.5	142.1	243.7	196.9	44.4	24.8	44.7	26.1	31.0	34.2
90	217.2	192.7	262.8	146.8	249.8	213.9	50.8	29.2	48.6	29.0	31.7	37.9
SEm±	3.4	2.8	5.2	5.2	2.1		1.2	3.8	1.2	1.3	0.3	
CD at 5%	9.9	8.4	15.0	15.2	5.9		3.6	NS	3.6	3.6	0.8	
C. Interaction: Entry X Phosphorus level												
SEm±	7.6		11.5	11.7			2.8		2.8	2.8		
CD at 5%	NS		NS	NS			NS		NS	NS		
CV%	7.0		8.2	14.9			10.8		11.1	18.8		

Table-22 (a-1): Interaction effect of phosphorus levels and entries on green fodder and dry matter yield of cowpea (AVTC-2) at Vellayani

Entry/ P levels	Vellayani							
	Green Fodder Yield (q/ha)				Dry Matter Yield (q/ha)			
	30	60	90	Mean	30	60	90	Mean
MFC 09-1	152.7	169.4	188.9	170.3	13.7	27.1	28.1	23.0
RR-3	151.4	108.3	184.7	148.1	21.3	29.3	25.9	25.5
UPC 9202 (ZC)	155.5	190.2	188.8	178.2	19.4	20.9	37.8	26.0
UPC 5286 (NC)	145.8	160.2	193.0	166.3	26.5	16.0	27.4	23.3
Bundel Lobia-1 (NC)	130.5	150.0	208.3	162.9	41.4	30.7	27.1	33.1
Mean	**147.2**	**155.6**	**192.7**		**24.5**	**24.8**	**29.3**	
	Entry	**P levels**	**Entry X N level**		**Entry**	**P levels**	**Entry X N level**	
SEm±	3.7	2.9	6.5		4.9	3.8	8.6	
CD at 5%	10.8	8.3	18.7		14.3	NS	14.2	
CV%								

Table -22(b): Effect of phosphorus levels on crude protein content and plant population/ m^2 of promising entries of cowpea (AVTC-2)

Treatment	Crude protein (%)			Plant population/ m^2				
	Dharwad	Hyderabad	Mean	Mandya	Vellayani	Coimbatore	Dharwad	Mean
A. Entries								
MFC 09-1	16.2	21.7	19.0	28.4	9.8	32.7	30.9	25.5
RR-3	16.1	21.3	18.7	29.6	11.2	32.2	31.0	26.0
UPC 9202 (ZC)	16.2	20.9	18.6	30.1	9.6	32.2	30.1	25.5
UPC 5286 (NC)	16.1	19.5	17.8	30.2	11.3	32.7	31.5	26.4
Bundel Lobia-1 (NC)	15.9	21.6	18.8	30.3	11.4	32.6	31.2	26.4
SEm±	0.10	0.5		0.6	0.3	0.2	0.4	
CD at 5%	0.20	1.4		NS	1.0	NS	NS	
B. Phosphorus levels (P_2O_5 kg/ha)								
30	15.6	19.7	17.7	29.9	9.3	32.3	30.4	24.0
60	16.2	22.3	19.3	29.8	10.7	32.5	31.2	24.8
90	16.4	20.9	18.7	29.5	12.0	32.5	31.2	25.2
SEm±	0.05	0.4		0.4	0.3	0.2	0.3	
CD at 5%	0.20	1.1		NS	0.8	NS	NS	
C. Interaction: Entry X Phosphorus level								
SEm±	0.1	0.8		1.0		0.4		
CD at 5%	0.3	NS		NS		NS		
CV%		6.9		5.7		2.0		

Table -22(c): Effect of phosphorus levels on crude protein yield (q/ha) and plant height of promising entries of cowpea (AVTC-2)

Treatment	Crude protein yield (q/ha)			Plant height (cm)					
	Dharwad	Hyderabad	Mean	Mandya	Vellayani	Hyderabad	Coimbatore	Dharwad	Mean
A. Entries									
MFC 09-1	5.0	5.7	5.4	57.1	222.1	69.5	106.3	51.6	109.3
RR-3	4.9	4.6	4.8	62.7	282.3	83.4	106.9	50.7	114.4
UPC 9202 (ZC)	5.0	6.4	5.7	68.6	246.0	80.4	109.3	51.6	96.5
UPC 5286 (NC)	5.0	4.9	5.0	72.6	193.0	93.3	108.3	51.3	101.7
Bundel Lobia-1 (NC)	4.6	5.5	5.1	56.5	232.0	83.7	107.2	50.2	105.3
SEm± CD at 5%	0.1 0.2	0.4 1.2		1.5 4.5	7.5 21.7	6.8 NS	4.2 NS	0.4 NS	
B. Phosphorus levels (P_2O_5 kg/ha)									
30	4.5	4.3	4.4	61.0	250.1	73.0	102.6	50.2	107.4
60	5.0	5.8	5.4	64.4	210.1	83.3	107.8	51.5	103.4
90	5.2	6.1	5.7	65.2	244.3	89.7	112.3	51.6	112.6
SEm±	0.05	0.3		1.2	5.8	5.2	3.3	0.3	
CD at 5%	0.13	0.8		3.5	16.8	NS	NS	0.9	
C. Interaction: Entry X Phosphorus level									
SEm±		0.6		2.7		11.7	7.3		
CD at 5%		NS		7.8		NS	NS		
CV%		20.3		7.3		25.3	8.9		

Table-22 (c-1): Interaction effect of phosphorus levels and entries on plant height of cowpea (AVTC-2) at Mandya

Entry/P levels	Plant height			
	30	60	90	Mean
MFC 09-1	58.5	51.7	61.2	57.1
RR-3	67.2	56.8	64.0	62.7
UPC 9202 (ZC)	64.8	73.0	68.1	68.6
UPC 5286 (NC)	62.9	78.4	76.7	72.7
Bundel Lobia-1 (NC)	51.6	62.1	55.8	56.5
Mean	**55.8**	**63.7**	**69.3**	
	Entry	**P levels**	**Entry X N level**	
SEm±	1.5	1.2	2.7	
CD at 5%	4.5	3.5	7.8	
CV%	7.3			

Table -22(d): Effect of phosphorus levels on leaf stem ratio of promising entries of cowpea (AVTC-2)

Treatment	Leaf stem ratio					
	South Zone					
	Mandya	Vellayani	Hyderabad	Coimbatore	Dharwad	Mean
A. Entries						
MFC 09-1	0.47	1.61	0.66	0.38	0.51	0.73
RR-3	0.42	1.12	0.76	0.37	0.51	0.64
UPC 9202 (ZC)	0.38	1.76	0.68	0.37	0.51	0.74
UPC 5286 (NC)	0.43	1.38	0.71	0.37	0.50	0.68
Bundel Lobia-1 (NC)	0.43	1.65	0.75	0.35	0.49	0.73
SEm±	0.1	0.1	0.07	0.01	0.03	
CD at 5%	NS	0.4	NS	NS	0.09	
B. Phosphorus levels (P_2O_5 kg/ha)						
30	0.42	1.41	0.64	0.35	0.50	0.66
60	0.44	1.69	0.73	0.37	0.51	0.75
90	0.43	1.41	0.76	0.38	0.51	0.70
SEm±	0.04	0.1	0.05	0.01	0.03	
CD at 5%	NS	NS	NS	NS	0.08	
C. Interaction: Entry x Phosphorus level						
SEm±	0.08		0.12	0.02		
CD at 5%	NS		NS	NS		
CV%	35.6		28.12	12.3		

CHAPTER-3

FORAGE CROP PROTECTION

Plant Protection

Forage crop protection trials in major *kharif* forages included pest occurrence, evaluation of varietal resistance in improved breeding materials to disease resistance and pest management. These were conducted at Bhubaneswar, Hyderabad, Jhansi, Ludhiana, Palampur and Rahuri centres. The major emphasis was on occurrence of disease and pests in different Kharif crops under different agro-climatic conditions, strengthening pest management.

PPT-1. MONITORING OF DISEASE, INSECT PESTS AND NEMATODES IN COWPEA, MAIZE, PEARL MILLET AND SORGHUM ECOSYSTEM.

Locations: Bhubaneswar, Hyderabad, Jhansi, Ludhiana, Palampur and Rahuri

Four cultivated forage crops sorghum, pearl millet, maize and cowpea were screened with objectives to record the occurrence and abundance of disease, insect pests and nematodes and their relationships with weather parameters at different locations. The crop-wise occurrence of pests and their abundance has been recorded as follows:

Sorghum

Diseases: At Jhansi, zonate leaf spot (*Gleocercospora sorghi*), anthracnose (*Colletotrichum graminicola*) and gray leaf spot (*Cercospora sorghi*), sooty stripe (*Ramulispora sorghi*) and leaf blight (*Helminthosporium turcicum*) were predominating diseases on sorghum *var* MP Chari. The disease incidence ranged from 20-70%. The disease development and spread was favoured by mean temperature around 30°C and humidity 80%. Among all the diseases, zonate leaf spot was maximum.

At Palampur, leaf blight incidence by *Helminthosporium turcicum* was initiated in the mid of July (5%) and progressed (20%) up to last week of August. Zonate leaf spot was more severe (8 ï 35%) as compared to leaf blight (5-20%).

At Ludhiana, zonate and gray leaf spot has been observed in severity. Zonate and grey leaf spot appeared on SL-44 variety of sorghum. The disease progressed rapidly up to first week of September due to occurrence of rains and RH (75-80%) and temperature (30°C). The disease showed steady and steep progression during the period with maximum disease severity of 32.7%. Disease is favoured by mean temperature range of 24-27°C and mean RH of 70-75%. Maximum disease was observed in October (53.7%) with pinkish fungal growth (sporodochia) and sporulation under the lesions due to high humidity of 90% during morning hours. Grey leaf spot appeared in the third week of July 2013 in the crop sown during first week of June, 2012. The disease progressed rapidly up to mid September 2013 due to occurrence of rains and RH and temperature of 75-80% and 30°C. Thereafter, in the second week of September the disease development was reduced due to absence of showers. With the maturity of crop (non-availability of green areas) and decrease in temperatures and RH, the disease development slowed down with maximum per cent disease severity of 69.0%.

At Bhubaneswar, Incidence of leaf spot and leaf blight started from 2nd week of August and progress up to first week of September (2.0 in 1-5 scale).

Insect fauna: At Bhubaneswar, leaf defoliatorôs starts from 2nd week of August. At the time of harvesting, infestation of leaf defoliators was (2.2 / 10 plants). At Rahuri, the incidence of shoot fly was moderate to high on sorghum crop sown during 3rd week of August. The maximum percentage of dead hearts was recorded during the 3rd week of August (72.48 %). The incidence of stem borer was negligible on sorghum (4- 7%).The aphid (*Rhopalosiphum maidis*) population in leaf whorl was (17.40 aphids/ plant) during the 4th week of August and was highest in the 2nd week of September (66.48 aphids/plant). During the severe infestation of aphids, the population of predatory lady bird beetles (2.6 adult & 5.8 grubs/ plant) and *Chrysoperla carnea* (1.0 to 1.2/plant) was observed.

At Jhansi, shoot fly infestation was maximum (30%) during first week of August in late sown Sorghum. Defoliators and shoot borer infestation were also recorded.

Pearl millet

Diseases: At Bhubaneswar, leaf spot and blight (*Helmithosporium sp.*) incidences recorded were 1.0-1.4% in 1-5 scale during the crop season. At Jhansi, leaf spot (*Pyricularia grisea*) was severe in the first week of September; the rust (*Puccinia pennesiti*) was severe in different genotypes of pearl millet and continued to increase in severity till the maturity.

At Ludhiana, leaf spot disease (*Pyricularia spp.*) started appearing in the mid of August. Disease progressed steadily during the crop season from Last week of august till last week of September with favourable temperature range of 28-30°C and RH of 70-75 %. Maximum disease severity of 42.5% was observed. At Palampur, leaf blight (*Helminthosporium sp)* appeared in the 2ndweek of July (5%) and progressed up to end of August (45%).

Insect fauna: At Bhubaneswar, infestation of insect pest started from 3rd week of August. Pest load was low in pearl millet (foliage feeder = 1.6 /10 plants). At Hyderabad, infestation of flea beetles was observed at the end of August and continued up to end of September

Plant parasitic nematodes: Before planting, among plant parasitic nematode, population was maximum in *Hoplolaimus indicus* (12 / 250 gm of soil) followed by *Helicotylenchus dihystera* (8 / 250 gm of soil), *Caloosia exilis* (60 / 250 gm of soil) and *Dorylaimus* sp. (25 /250 gm of soil). It was observed that population increased at the time of harvesting to 20 per 250 gm of soil for *H. indicus* followed by *H. dihystera* (15 /250 gm of soil), *C. exilis* (85 /250 gm of soil) and *Dorylaimus* sp (30/ 250 gm of soil).

Predators/ parasites/pollinators: Various predators/ parasites/pollinators were also recorded during the monitoring period namely Epilachna beetle, Black ant, Butterfly, Flies, Spiders and Wasps. Numbers of black ants was maximum (25.8 /10 plants) at the time of harvesting.

Maize

Disease: At Bhubaneswar, leaf blight incidence started from first week of August and progressed up to first week of September (2.4) on 1-5 scale. At Ludhiana, severity of maydis leaf blight was noticed in the first week of August 2013 on var J 1006 and progressed rapidly up to mid September 2013 as max RH above 70-75% and mean temperature was 28-31°C. Thereafter, as the crop reached physiological maturity and no rain was received after mid September leading to reduction in humidity, the disease progressed slowly with max disease severity of 46.8%. At Palampur, leaf blight (*H. maydis* and *H tercecium*) appeared in the second week of July and severity continued to increase (25%) up to the 3rd week of August. Banded leaf and sheath blight (*Rhizoctonia sp*) were also observed in mild form. The incidence of stem borer on maize was negligible, whereas, *Helminthosporium* leaf blight disease was observed in severe form in maize seed production plot throughout the crop period at Rahuri. At Jhansi, incidences of maydis leaf blight were recorded during the crop season.

Insect fauna: Infestation of foliage feeders started from 2nd week of August and progressed up to first week of September till the time of harvesting (2.0/10 plants) at Bhubaneswar. The stem borer was also observed in the month of August at Palampur and Hyderabad.

Cowpea

Diseases: At Bhubaneswar, Cowpea mosaic was reported in 3rd week of August and at the time of harvesting, its rating was 1.8 (in the scale of 1-5). Root rot incidence started from first week of August (6%) and continued to increase (42.0%) up to first week of September. At Jhansi, incidence of root rot (*Rhizoctonia solani, R. bataticola and Sclerotium rolfsii*) appeared in severe form due to heavy rains. Anthracnose (*Colletotrichum lindemuthianum*) was also in severe form in some of entries under evaluation in cowpea seed crop. Cowpea mosaic also appeared in traces at Jhansi and Hyderabad.

At Palampur, wilt / root rot *(Fusarium and Rhizoctonia sp*) were severe (28-42%) during July. Leaf spot and leaf blight (*Ascochyta and phyllosticta* sp) appeared in the 2ndweek of July and increased continuously (up to 30%) in the last week of August. *Phytophthora* blight appeared in the third week of July and increased up to first week of August (10-45%). Anthracnose (*C. lindemuthianum*) was observed in 3rd week of July (12%) and mosaic diseases appeared late in the season and

remained stationary till the end of August. At Rahuri, yellow mosaic virus was moderate to high throughout the crop period.

Insect fauna: At Bhubaneswar, cowpea aphid (20-157/leaf with 10 cm petiole) and flea beetle (12.6-114.6 holes/plant) were recorded during the crop season. Leaf defoliatorôs incidences were mild (1-2 / 10 plants). At Hyderabad, aphid infestation appeared in the second week of August (4%) with maximum infestation (25%) in the end of September. At Palampur, pod borer infestation was 5-9% during month of August. At Rahuri, low to moderate infestation of aphids and jassids was recorded (1.33-27.66 / plant) in the month of August to mid September. The population of coccinellids ranged from 0.33 to 1.33/plant during the infestation of aphids.

PPT-2. EVALUATION OF VARIETAL TRIALS OF COWPEA, MAIZE AND PEARL MILLET FOR RESISTANCE TO DISEASES, INSECT - PESTS AND NEMATODES

Location: Bhubaneswar, Hisar, Hyderabad, Jhansi, Ludhiana and Rahuri

2.1. Cowpea

The cowpea entries of initial and advance varietal trials were evaluated for reaction to various diseases and insect-pests. In the initial varietal trial (table PPT 2.1.1 & 2), entry BL-1 showed least infestations of aphids at Hyderabad whereas at Rahuri entries did not differ in aphid infestation. Jassid defoliator infestation was also least in BL-1 at Rahuri. All the entries showed susceptible to moderately susceptible reaction of leaf blight at Palampur and Ludhiana centre. All the entries showed minimum root rot disease at Jhansi except SKFC-1 and HBC-11-3 at Bhubaneswar. While all the entries were free from root rot at Ludhiana. At Rahuri, Ludhiana all the entries did not differ in the incidences of yellow mosaic virus disease except SKFC-1 at Ludhiana. At Hyderabad all the entries were moderately resistance to moderately susceptible for YMV, except UPC 9202 which showed resistance, flea beetle were also recorded in all the entries. In AVT, All the entries were resistant for YMV and root rot at Bhubaneswar and Jhansi. However, only two entries at TNFC-0924 and UPC-5286 were resistant at Hyderabad table PPT 2.1.3.

Table PPT 2.1.1. Screening for pest resistance in Cowpea- Initial Varietal Trial

Entries	Aphid infestation	Jassids/ leaf	Stem and Leaf blight / Leaf spot	
	Rahuri	Rahuri	Palampur	Ludhiana
BL-2	-	-	-	46.2
BL-1	2.67	1.81	38.8	54.0
UPC-9202	4.89	2.19	-	-
TNFC-0926	3.11	1.63	45.8	54.0
MFC-09-9	6.44	2.11	49.3	41.0
SKFC-1	3.00	2.91	41.8	63.2
UPC-5286	4.00	1.56	40.0	48.7
UPC-622	-	-	46.3	-
HBC-11-3	6.67	3.00	44.3	38.5
UPC-1301	3.67	1.69	56.0	43.2

Table PPT 2.1.2 Screening for disease resistance in Cowpea- Initial Varietal Trial

Entries	Root rot (%)			Yellow mosaic virus				Flea beetles
	Bhubaneswar	Jhansi	Ludhiana	Ludhiana	Jhansi	Rahuri	Hyderabad	
BL-2	-	0.0	0.0	1.6	0.0	-	-	-
BL-1	1.6	2.0	0.0	1.0	0.0	1.00	29	60
UPC-9202	-	1.3	-	-	0.0	1.67	9	56
TNFC-0926	3.3	1.3	0.0	1.8	0.0	1.33	28	68
MFC-09-9	1.6	2.6	0.0	2.9	0.0	2.67	22	78
SKFC-1	43.3	2.3	0.8	33.0	0.0	3.00	10	50
UPC-5286	5.0	3.6	0.1	0.5	0.0	1.00	17	64
UPC-622	6.6	1.0	-	-	0.0	-	28	64
HBC-11-3	56.6	0.6	0.0	2.3	0.0	3.33	12	69
UPC-1301	1.6	1.6	0.0	1.1	0.0	1.67	29	60

Table PPT 2.1.3. Screening for disease resistance in Cowpea- Advance Varietal Trial

Entries	Root rot		Yellow mosaic virus			Flea beetles
	Jhansi	Bhubaneswar	Bhubaneswar	Jhansi	HYD	HYD
MFC-09-5	2.3	1.6	1.2	0.0	40	60
UPC-622	1.3	3.3	0.1	0.0	-	-
BL-1	2.3	1.6	0.2	0.0	19	63
UPC-5286	3.6	1.6	0.1	0.0	11	57
TNFC-0924	2.6	6.6	0.2	0.0	4	67
UPC-9202	1.6	-	-	0.0	36	50

2.2. Pearl Millet

In initial varietal trial (table PPT 2.2.1), all the entries were found resistant to leaf spot and sheath blight at Bhubaneswar however at Ludhiana RBB-4, AFB-9 and DFMH-30 showed moderately resistant reactions against leaf spot. All the entries showed resistance to downy mildew at Ludhiana and leaf spot at Jhansi.

In advance varietal trial all the entries showed resistance to leaf spot and sheath blight at Bhubaneswar and Jhansi (table PPT 2.2.2).

Table PPT 2.2.1 Screening for disease resistance in Pearl Millet- IVT

Entries	Downy mildew	Leaf spot (1-5 scale)			Sheath Blight (%)
	Ludhiana	Ludhiana	Jhansi	Bhubaneswar	
Giant Bajra	0.0	29.3	1.6	0.2	5.3
HBP-12-3	0.0	27.3	1.3	0.1	9.3
AVKB-19	0.0	30.6	1.3	0.1	2.7
RBB-4	0.0	16.0	1.6	0.1	4.0
NDFB-939	0.0	43.3	1.0	0.2	6.7
AFB-9	0.0	13.3	1.3	0.1	5.3
Raj Bajra chari-2	0.0	26.0	1.0	0.2	6.7
DFMH-30	0.0	12.0	1.6	0.2	1.3

Table PPT 2.2.2. Screening for disease and pest resistance in Pearl Millet- AVT

Entries	Sheath Blight (%)	Leaf spot (1-5 scale)	
	Bhubaneswar	Bhubaneswar	Jhansi
AFB-8	4.0	0.2	1.3
AVKB-19	6.6	0.1	1.0
Giant Bajra	10.6	0.6	1.6
NDFB-936	5.3	0.2	1.3
Raj Bajra Chari-2	4.0	0.2	1.6
APFB-09-1	2.6	0.2	1.3

2.3 Maize

In initial varietal trial, (table PPT 2.3.1), all the entries were found susceptible to moderately susceptible for maydis leaf spot at Ludhiana, however at Rahuri, all the entries were resistance to moderately resistance. All the entries were found resistant to moderately resistant for leaf blight at Jhansi, Palampur and Bhubaneswar. In hybrid trials, all the entries were found moderately resistant at Palampur and Bhubaneswar but susceptible at Ludhiana for maydis leaf spot (Table 2.3.2).

Table PPT 2.3.1. Screening for diseases and pest resistance in IVT on Maize

Entries	Maydis leaf spot (%)		Maize sheath blight (*T. turcicum*) (1-5 scale)			Stem borer
	Ludhiana	Rahuri	Palampur	Bhubaneswar	Jhansi	Rahuri
JHM-13-1	29.7	8.3	9.7	2.6	2.6	1.67
BAIF Maize -3	44.3	6.6	7.3	8.0	3.3	1.33
J-1006	36.3	5.0	10.0	10.6	3.6	2.67
African tall	31.4	10.0	7.0	1.3	0.6	2.00
AFM-3	40.3	5.0	11.7	4.0	1.3	2.00
AFM-2	44.7	16.6	12.0	5.3	1.6	1.33
PFM-7	54.9	15.0	16.3	9.3	2.6	1.67
AFM-1	44.7	15.0	12.0	12.0	3.3	2.67

Table PPT 2.3.2. Screening for diseases and pest resistance in Hybrid Trial on Maize

Entries	Maydis leaf spot (%)	Maize leaf blight (*T. turcicum*) (1-5 scale)		
	Ludhiana	Jhansi	Palampur	Bhubaneswar
PMH-1	41.5	1.3	7.3	9.3
J-1006	39.2	2.3	10.5	5.3
African tall	37.9	0.3	10.8	4.0
PMH-3	36.5	1.6	8.0	6.7
PMH-117	35.5	1.3	7.8	2.7
PAC-745	34.2	1.0	11.5	8.0

2.4 Ricebean

In IVT all entries were found resistant to leaf spot and root rot at Bhubaneswar. All the entries were found disease free at Jhansi (Table PPT. 2.5.1).

Table PPT. 2.5.1. Screening for pest resistance in Rice bean - IVT

Entry	Leaf spot		Root rot
	Bhubaneswar	Jhansi	Bhubaneswar
RBL-6	0.2	0.0	2.0
DFRB-17	0.2	0.0	1.0
Bidhan-1	0.4	0.0	1.2
JRBJ-06-3	1.0	0.0	3.4
JRB-19	0.2	0.0	4.0
JRB-18	0.2	0.0	3.0
Bidhan-2	0.2	0.0	1.7

PPT. 10. VALIDATION OF MANAGEMENT OF ROOT ROT DISEASE IN COWPEA

Location: Bhubaneswar

The trial was conducted in paired plot design consisting of 2 treatments *viz.,* T_1: Seed treatment (ST) with *Trichoderma viride* (5g/kg) seed + FYM (2 tons/ha), T_2 : Untreated control. Seed treatment with *Trichoderma viride* @ 5 g/kg seed + FYM @ 2 t/ha was statistically significant in respect to GFY (141.0 q/h), DMY (29.0 q/h) and Net Monetary Return (6915.4 Rs/ha/yr) as compared to untreated control as well as % germination *in vitro* as well as *in vivo.*

Table PPT.10.1 disease incidence, fodder yield and net monetary return in different treatments

Treatment	% germination		Green forage yield	Dry matter yield	Net Monetary Return
	(*In vitro*)	(*In vivo*)	(q / ha)	(q / ha)	Rs./ha/year
T1	98.0	90.1	141.1	29.0	6915.4
T2	94.5	79.1	79.9	16.6	4634.8

T_1: Seed treatment (ST) with *Trichoderma viride* (5g/kg) seed + FYM (2 tons/ha), T_2: Untreated control.

PPT: 14 MANAGEMENT OF FOLIAR DISEASES OF FORAGE SORGHUM

Location: Bhubaneswar, Palampur, Ludhiana and Jhansi

The trial was conducted in second year for management of foliar diseases of sorghum with following treatments

T1: Seed treatment with carbendazim 2g/kg seed
T2: Seed treatment with *T.viride* 5g/kg seed
T3: Two foliar sprays of *T. viride* 0.5%
T4: Two foliar sprays of propiconazole 0.1%
T5: Two foliar sprays of copper oxy chloride 0.3%
T6: T1 + two foliar sprays of propiconazole 0.1%
T7: T2 + two foliar sprays of propiconazole 0.1%
T8: T1+two foliar sprays of copper oxy chloride 0.3%
T9: T2+ two foliar sprays of copper oxy chloride 0.3%
T10: Control

Bhubaneswar: All the treatments were found to be significantly effective to reduce disease incidence and severity and to increase the green forage yield as compared to untreated/ control plot. Among different treatments, lowest disease incidences as well as highest forage yield were recorded in T_6 and T_7 treatments (Table PPT 14.1).

Jhansi: All the treatments were found to be significantly effective to reduce disease incidence and severity and increase the green forage yield as compared to untreated/ control plot. However, among different treatments, lowest disease incidence was recorded in T_4 but highest forage yield were recorded in T_7 (Table PPT 14.1).

Table PPT 14.1. Efficacy of foliar spray on foliar diseases and GFY of forage sorghum

Treatments	Leaf blight severity	Leaf blight incidence		GFY (q/ha)	
	Bhubaneswar		Jhansi (1-5 Scale)	Jhansi	Bhubaneswar
T1	8.9	43.3	6.6	241.50	259.2
T2	10.4	56.6	11.6	233.25	235.0
T3	7.9	40.0	15.0	291.50	262.1
T4	4.5	31.6	5.0	325.0	294.2
T5	6.4	38.3	13.3	266.5	267.6
T6	2.3	13.3	3.3	300.0	314.5
T7	4.2	18.3	8.3	333.25	308.7
T8	5.4	20.0	10.0	275.0	297.3
T9	5.8	33.3	15.0	283.25	270.6
T10	19.0	76.6	18.3	216.5	210.1
CD (p=0.05)	**2.3**	6.3	8.0	16.1	**17.3**

At Ludhiana and Palampur, seed treatment with carbendazim + two foliar sprays of propiconazole 0.1% showed the least blight severity (33.5 and 12.8%) followed by two foliar spray of propiconazole (35.0 %) at Ludhiana however at Palampur seed treatment with *T.viride* 5g/kg seed + two foliar sprays of propiconazole 0.1% showed (16.3%) blight severity, respectively (Table PPT 14.2). The green fodder yield was also more in these treatments as compared to control.

Table PPT 14.2. Efficacy of foliar spray on foliar diseases and GFY of forage sorghum

Treatments	Leaf blight severity (%)		Green Fodder Yield (q/ha)	
	Ludhiana	Palampur	Ludhiana	Palampur
T1	57.0	28.7	391.6	281.3
T2	62.5	33.5	366.6	273.6
T3	59.0	34.3	370.8	256.0
T4	35.0	19.0	400.0	296.6
T5	69.5	64.5	362.5	247.1
T6	33.5	12.8	395.8	304.9
T7	35.5	16.3	379.2	293.8
T8	65.0	61.4	370.8	251.7
T9	69.0	55.5	362.5	254.0
T10	73.0	74.4	354.2	234.4
CD (p=0.05)	8.93	2.93	NS	10.15

PPT-15. INTEGRATED MANAGEMENT OF ROOT ROT AND FOLIAR DISEASES OF FORAGE COWPEA

Locations: Bhubaneswar, Palampur, Ludhiana and Jhansi

The experiment was conducted to evaluate the losses due to root rot and foliar diseases of cowpea by using different dates of sowing with seed treatment by biocontrol agents and foliar spray of fungicides.

The trial consisted of following main plots and sub-plots

Main plot: three dates of sowing *viz.,*

- A_1 15 days before normal date of sowing,
- A_2 normal date of sowing
- A_3 15 days after normal date of sowing.

Sub-plots: There were 4 sub plots with 4 treatments:

- T_1 = No treatment (Control)
- T_2 =Seed treatment with *Trichoderma viride* + *Paecilomyces lilacinus* @ 5 g/kg seed each followed by foliar sprays of propiconazole @ 1ml/l at 15 days interval.
- T_3 =Seed treatment with tebuconazole 2DS @ 1g/kg seed + NSKP(50 g/kg seed) followed by foliar spray of propiconazole @ 1ml/l at 15 days interval.
- T_4 =Seed treatment with metalaxyl 8% + Mancozeb 64% @ 2.5g/kg seed + NSKP(50 g/kg seed) followed by foliar spray of propiconazole @ 1ml/l at 15 days interval.

Bhubaneswar: Early sowing (A_1) recorded minimum root rot incidence and highest yield followed by A_2 and A_3. In respect to climatic condition from the time of sowing till harvesting, it was recorded that average maximum temperature (32.4^{o}C), in A_1 relative humidity 86.5% in A_2 and rainfall 51.9 mm in A_3 was more at Bhubaneswar (Table PPT15.1). Among different sub plots all the treatments recorded less root rot incidence, more green fodder yield and dry matter yield as compared to Untreated Plot (T_1). However, minimum root rot incidence and highest yield was recorded in T_2 and T_3 which were statistically at par (Table PPT15.2)

Table PPT 15.1 Average of Max. Min. Temp., Relative Humidity and Rainfall during the crop period at different period of sowing.

(On Average Week wise Basis)				
Treatment (Date of Sowing)	Average Max Temp. (°C)	Average Min Temp. (°C)	Average Relative Humidity (%)	Average Rainfall (mm)
A_1	32.4	25.3	86.2	46.8
A_2	32.1	25.0	86.5	51.9
A3	32.3	24.8	85.8	58.4

PPT-15.2 Effect of date of sowing on diseases and yield of forage cowpea

Treatments		Root rot incidence (%)	Yield (q/ha)	
Main (DOS)	Sub.		GFY	DMY
A_1	T1	50.7	147.5	30.5
	T2	15.3	208.3	43.3
	T3	12.7	214.2	44.2
	T4	21.3	195.8	40.8
A_2	T1	52.7	144.4	29.6
	T2	20.0	198.3	41.3
	T3	19.3	199.8	42.0
	T4	28.0	183.9	38.6
A_3	T1	55.3	140.2	29.2
	T2	38.7	166.2	33.8
	T3	35.3	171.6	36.0
	T4	45.3	155.8	32.2
CD (p= 0.05)		5.4	14.5	3.1

Ludhiana: Mosaic was quiet less in T3 plots as compared to other treatments. First date of sowing (A1) showed higher disease incidence as compared to other two dates of sowing. Occurrence of root rot was negligible (Table PPT 15.3). The mean of green fodder yield was maximum (497.58 q/ha) in T3 plots besides high incidence of mosaic, the green fodder yield was maximum on first date of sowing (A1) followed by crop sown on later.

PPT-15.3 Effect of date of sowing on diseases and yield of forage cowpea

Treatments		Severity / incidence of Diseases		Green Fodder Yield (q/ha)
Main (DOS)	Sub.	YMV	Root rot	
A1	T1	9.6	0.37	643.7
	T2	8.8	0.0	665.6
	T3	7.7	0.0	729.2
	T4	8.5	0.0	675.0
A2	T1	5.2	0.37	440.6
	T2	4.4	0.0	450.0
	T3	3.3	0.0	521.8
	T4	3.6	0.0	478.1
A3	T1	5.9	0.37	187.5
	T2	5.1	0.0	196.8
	T3	2.9	0.0	241.7
	T4	3.3	0.0	212.5
CD (p= 0.05)		1.0	NS	38.2
DOS × treatments		NS	NS	NS

Palampur: Early sowing (A1) recorded minimum root rot incidence while anthracnose and leaf blight followed different trends. As shown in the table PPT15.4, root rot incidences increased with the delay in sowing of the crop. Minimum incidence (11.4%) was observed in early sown crop (A1) and maximum (41.4%) in late sown crop (A3). However, the disease severity of Anthracnose was maximum (26.3%) on early sown crop & minimum (12.5%) in late sown (A3). In case of leaf blight, the severity was maximum (25.4%) in the normal sowing date (A2) & minimum (13.4%) in late sown crop (A3). The nematode population also increased with the delay in sowing. Among different treatments T3 and T4 were statistically at par. In relation to the environmental factors root rot incidence started early in initial dates of sowing while leaf blight started later in all the dates of sowing.

PPT-15.4 Effect of date of sowing on diseases and nematodes of forage cowpea

Treatment		Severity/ incidence of Diseases and nematodes					Yield (q/ha)	
Main (DOS)	Sub	Root rot	Anthracnose	Leaf blight	Nematodes /g of soil		GFY	DFY
					Before sowing	After harvest		
A1	T_1	11.4	26.3	18.1	125.0	273.3	42.6	15.2
	T_2	8.4	8.4	5.4	125.0	134.0	49.8	15.5
	T_3	3.5	7.1	4.1	125.0	128.3	54.4	16.4
	T_4	4.1	7.0	3.4	125.0	121.0	54.1	16.4
A2	T_1	19.0	22.7	25.4	150.0	313.3	46.1	14.9
	T_2	16.0	6.6	6.6	150.0	156.7	50.4	15.2
	T_3	8.4	5.1	5.1	150.0	155.7	56.8	16.8
	T_4	8.3	4.9	4.8	150.0	150.0	58.5	16.8
A3	T_1	41.4	12.5	13.4	170.0	410.0	39.4	14.1
	T_2	36.3	3.8	3.2	170.0	188.3	42.8	15.5
	T_3	12.5	3.2	3.2	175.0	200.0	50.3	16.1
	T_4	13.7	2.7	3.1	175.0	193.0	50.2	15.7
CD (P=0.05)								
A (date of sowing)		1.02	1.06	1.28	0.0003	14.06	1.38	0.26
B (Treatments)		1.18	1.23	1.48	0.0003	16.23	1.60	0.30
A x B		2.04	2.17	2.56	0.0005	28.13	NS	0.52
CV		7.89	13.65	18.96	0.0	8.22	3.29	1.96

Jhansi: Due to heavy and continuous rain during the crop period, the crop growth was not good therefore, green fodder yield was poor. However, all the treatment in three sowing dates was found effective against the root rot and foliar disease (Table PPT 15.5). Among different treatments T2 (Seed treatment with *Trichoderma viride* + *Paecilomyces lilacinus* @ 5 g/kg seed each followed by foliar sprays of propiconazole @ 1ml/l at 15 days interval) was found to be the best treatment as it reduced the disease to maximum extent and in turn provided maximum GFY.

PPT-15.5 Effect of date of sowing on diseases and yield of forage cowpea

Treatments		Severity / incidence of Diseases (%)		Green Fodder Yield (q/ha)
Main (DOS)	Sub.	Root rot	Anthracnose	
A1	T1	30.0	42.6	125.0
	T2	16.6	34.3	182.5
	T3	18.3	24.6	175.0
	T4	26.6	28.3	165.0
A2	T1	16.6	22.6	110.0
	T2	13.3	18.3	125.0
	T3	10.0	16.6	107.5
	T4	16.6	16.3	150.0
A3	T1	13.3	18.3	82.5
	T2	10.0	14.6	100.0
	T3	10.0	11.6	115.0
	T4	11.6	15.6	100.0
CD (p= 0.05)		4.2	2.4	12.3

CHAPTER-4

BREEDER SEED PRODUCTION

Breeder seed production in Forage Crops (Kharif-2013)

(Table Reference: Table1 & Table2)

In Kharif-2013, the indent for Breeder Seed Production was received from DAC, GOI for 29 varieties in six forage crops *viz*., Maize, Pearl millet, Cowpea, Sorghum, Guar and Rice bean. The total indents for breeder seed production was 152.22 q and was allocated to 13 SAUs/ICAR/NGO institutes. Among quantity allocated for different forage crops, the maximum was for Maize (89.00 q) followed by Sorghum (33.35 q), Cowpea (20.05 q), Guar (4.10), Rice bean (3.00 q) and minimum was for Pearl millet (2.72 q) which indicates, substantial demand for Maize, Sorghum and Cowpea at national perspective.

The final Breeder Seed Production Report (BSP-IV) received from different seed producing centres revealed that in crops such as Maize, Pearl millet and Rice bean (expected yield) , the overall breeder seed production was higher with respect to allocated quantity whereas in crops like Cowpea, Sorghum and Guar, the breeder seed production was less than the allocated quantity. Coming to the crop wise scenario, as compared to allocation in Maize, the production was 137.5 q (48.5 q surplus), in Pearl millet production was 6.32 q (3.60 q surplus) and in Rice bean the production was 4.20 q (1.20 q surplus). However in cowpea, the production was 10.00 q (10.05 q deficit) against the allocation of 20.05 q. Similarly in Sorghum, there was 13.91 q deficits in production with respect to 33.35 q allocation and in Guar; against the allocation of 4.10 q the actual production was 0.80 q (3.30 deficit). The overall breeder seed production was 178.26 q against the allocation of 152.22 q, which was 26.04 surplus or 17.11 per cent higher than the quantity allocated.

Table 1: Center wise Breeder Seed Production (q) Kharif-2013

S. N.	Producing Centre	variety	Crop	DAC indent	Actual allocation	Actual Production	Production surplus (+)/ Deficit (-)
1.	MPKV, Rahuri	African Tall	Maize	26.00	26.00	70.00	(+) 44.00
2.	BAIF, Urulikanchan	African Tall	Maize	22.00	22.00	23.00	(+) 1.00
3.	PAU, Ludhiana	J-1006	Maize	36.50	36.50	40.00	(+) 3.50
		PCB-164	Pearl millet	1.20	1.20	5.00	(+) 3.80
		CL-367	Cowpea	1.90	1.90	2.00	(+) 0.10
		Ageta Guara-112	Guar	0.40	0.40	0.60	(+) 0.20
		Guara-80		0.40	0.40	0.20	(-) 0.20
4.	MPUAT, Udaipur	Pratap Makka Chari-6	Maize	4.50	4.50	4.50	-
5.	GBPUA&T, Pantnagar	UPC-628	Cowpea	3.00	3.00	3.00	-
		UPC-625		1.50	1.50	2.00	(+) 0.50
		UPC-9202		1.15	1.15	2.00	(+) 0.85
6.	IARI RRS, Karnal	Pusa Chari-23	Sorghum	20.20	20.20	8.68	(-) 11.52
		Pusa Chari-6		1.80	1.80	0.16	(-) 1.64
7.	HAU, Hisar	Haryana Jowar-513	Sorghum	1.00	1.00	4.50	(+) 3.50
		Haryana Chari-308		2.30	2.30	2.50	(+) 0.20
		HC-136		0.25	0.25	0.25	-
		HC-20	Pearl millet	1.22	1.22	1.22	-
		FS-277	Guar	0.10	0.10	Nil	(-) 0.10
8.	AAU, Anand	Gujarat Fodder Sorghum-5	Sorghum	0.60	0.60	0.60	-
		GFC-3	Cowpea	1.00	1.00	1.00	-
9.	TNAU, Coimbatore	CO (FS)-29	Sorghum	2.75	2.75	2.75	-
10.	RAU, Bikaner	Raj Bajra Chari-2	Pearl millet	0.10	0.10	0.10	-
11.	IGFRI, RRS, Avikanagar	Avika Bajra Chari-19	Pearl millet	0.20	0.20	Nil	(-) 0.20
12.	IGFRI, Jhansi	EC-4216	Cowpea	9.50	9.50	Nil	(-) 9.50
		Bundel Lobia-2		2.00	2.00	Nil	(-) 2.00
		MP Chari	Sorghum	4.45	4.45	Nil	(-) 4.45
		Bundel Guar-1	Guar	3.00	3.00	Nil	(-) 3.00
		Bundel Guar-3		0.20	0.20	Nil	(-) 0.20
13.	BCKV, Kalyani	Bidhan-1	Rice Bean*	2.00	2.00	3.50	(+) 1.50
		Bidhan-2		1.00	1.00	0.70	(-) 0.30

***- Expected yield**

Table 2: Variety wise Breeder Seed Production (q) Kharif-2013

Crop	Name of Variety	DAC Indent	Allocation as per BSP-1 target	Actual Production	Production surplus (+)/ Deficit (-)
Maize	African Tall	48.00	48.00	93.00	(+) 45.00
	J-1006	36.50	36.50	40.00	(+) 3.50
	Pratap Makka Chari-6	4.50	4.50	4.50	-
	Total	**89.00**	**89.00**	**137.5**	**(+) 48.5**
Pearl Millet	PCB-164	1.20	1.20	5.00	(+) 3.80
	HC-20	1.22	1.22	1.22	-
	Raj Bajra Chari-2	0.10	0.10	0.10	-
	Avika Bajra Chari-19	0.20	0.20	Nil	(-) 0.20
	Total	**2.72**	**2.72**	**6.32**	**(+) 3.60**
Cowpea	CL-367	1.90	1.90	2.00	(+) 0.10
	UPC-628	3.00	3.00	3.00	-
	UPC-625	1.50	1.50	2.00	(+) 0.50
	UPC-9202	1.15	1.15	2.00	(+) 0.85
	GFC-3	1.00	1.00	1.00	-
	EC-4216	9.50	9.50	Nil	(-) 9.50
	Bundel Lobia-2	2.00	2.00	Nil	(-) 2.00
	Total	**20.05**	**20.05**	**10.00**	**(-) 10.05**
Sorghum	Pusa Chari-23	20.20	20.20	8.68	(-) 11.52
	Pusa Chari-6	1.80	1.80	0.16	(-) 1.64
	Haryana Jowar-513	1.0	1.0	4.50	(+) 3.50
	Haryana Chari-308	2.3	2.3	2.50	(+) 0.20
	HC-136	0.25	0.25	0.25	-
	Gujarat Fodder Sorghum-5	0.60	0.60	0.60	-
	CO (FS)-29	2.75	2.75	2.75	-
	MP Chari	4.45	4.45	Nil	(-) 4.45
	Total	**33.35**	**33.35**	**19.44**	**(-) 13.91**
Guar	Ageta Guara-112	0.40	0.40	0.60	(+) 0.20
	Guara-80	0.40	0.40	0.20	(-) 0.20
	FS-277	0.10	0.10	Nil	(-) 0.10
	Bundel Guar-1	3.00	3.00	Nil	(-) 3.00
	Bundel Guar-3	0.20	0.20	Nil	(-) 0.20
	Total	**4.10**	**4.10**	**0.80**	**(-) 3.30**
Rice Bean*	Bidhan-1	2.00	2.00	3.50	(+) 1.50
	Bidhan-2	1.00	1.00	0.70	(-) 0.30
	Total	**3.00**	**3.00**	**4.20**	**(+) 1.20**
Grand Total		**152.22**	**152.22**	**178.26**	**(+) 26.04**

***- Expected yield**

APPENDICES

APPENDIX-I

FORAGE BREEDING ACTIVITIES AT AICRP-FC-KHARIF -2013-14

SKRAU, Bikaner

GERMPLASM MAINTENANCE, EVALUATION AND COLLECTION

S. No.	Range grass/fodder crop	No. of accessions
1	*Lasiurus sindicus*	340
2	*Cenchrus ciliaris*	50
3	*Cenchrus setigerus*	90
4	*Cymbopogon jwarancusa*	50
5	Pearl millet	30

PASTURE GRASSES

Promising entries of range grasses, viz., 10 for *Lasiurus sindicus*, six for *Cenchrus ciliaris* and 12 for *Cenchrus setigerus* were evaluated in RBD. 10 promising entries of *Cenchrus ciliaris* were evaluated in large plots of 100 m^2 size. At this time, two entries of *C. ciliaris*, three entries of *C. setigerus* and six entries of *L. sindicus* are being tested at national level in coordinated trials, which have been contributed from Bikaner centre. Year of testing was first for *C. ciliaris* entries and fourth for *C. setigerus* and *L. sindicus* entries.

One variety of *Cenchrus ciliaris* RCCB-2 (Bikaneri Dhaman) developed at Bikaner centre of AICRP on Forage Crops and tested in AICRP trials during 2006 to 2009 for four years has been identified by Rajasthan State Seed Varietal Evaluation Committee for release in Rajasthan state in 2013.

OTHER FODDER CROPS

One pearl millet entry contributed by Bikaner centre was tested in coordinated trials at national level during Kharif-2013.

One variety of pearl millet RBB-1 (Raj Bajra-1) developed at Bikaner centre of AICRP on Forage Crops and tested in AICRP trials during 2006 to 2009 for three years has been identified by Rajasthan State Seed Varietal Evaluation Committee for release in Rajasthan state in 2013.

Available germplasm of pearl millet was evaluated. New crosses were made among plants of RBC-2, Giant Bajra, RBB-1, AVKB-19, RBB-2 and RBB-4. Selection of superior plants was also done to make a better composite.

GENETIC STUDIES IN FODDER CROPS

One experiment for M. Sc. (Ag.) thesis work was completed under guidance of Dr. S. S. Shekhawat. The title was ñVariability and Character Association Studies in Pearl Millet (*Pennisetum glaucum* (L.) R. Br.)ò. Thirty pearl millet genotypes including three check varieties were evaluated for GFY and related morphological characters in RBD with three replications. From the results obtained from the study, it was concluded that genotypes were significantly different for all the 13 characters indicating sufficient variability in the experimental material. The characters dry matter yield, leaf: stem ratio, green fodder yield, leaf area, spike length and number of tillers per meter row length showed high GCV and PCV. High estimates of heritability along with high genetic advance (% of mean) were observed for number of tillers per meter row length, leaf stem ratio, spike length, GFY, DMY and leaf area. Therefore, selection for these characters will be more effective.

Based on correlation, it was concluded that days to 50% flowering, plant height, number of tillers per meter row length, leaf: stem ratio, leaf length, leaf width, stem thickness, spike length, dry matter yield and leaf area were having positive and significant correlation with GFY. Path coefficient analysis revealed that dry matter yield, leaf area, plant height, leaf: stem ratio, number of tillers per meter row length and spike length were having high positive direct effect on green fodder yield. Thus, the selection for these characters will be effective to improve of green fodder yield in pearl millet. On the basis of superior performance, the genotypes RBB-1, AFB-3, GFB-1, RBB-2, RBB-3 and NDFB-13 were found superior for green fodder yield (q/ha). These genotypes may further be utilized in breeding programme aimed at improving green fodder yield in pearl millet.

AAU, Anand

New Collection: Four new germplasm lines were collected in Forage Sorghum.

Maintenance of germplasm:

Sr. No.	Name of the Crop	Total Number of lines/varieties
1.	Sorghum	563
2.	Maize	159
3.	Pearl millet	56
4.	Cowpea	31
5.	Sorghum sterile lines & its maintainer	8

Bajra:

New crosses:

1.	GAB-51	x	GFB-1
2.	GAB-51	x	J-2500
3.	GAB-51	x	J-2509
4.	GAB-51	x	FB-4
5.	GAB-51	x	Gaint Bajra
6.	GFB-1	x	FB-4
7.	GFB-1	x	FB-5
8.	GFB-1	x	J-2290
9.	GFB-1	x	MJC-2

- Thirty F_1's were grown, selfed and harvested for next generation.
- Forty five F_2 were grown, selfed after selection and harvested for next generation.
- Twenty eight F_3 progenies were sown and Twenty one single plant selections were selected and harvested for next generation.
- Nineteen F_3 progenies received from Regional Research Station, Anand Agricultural University, grown and seventeen single plant selections were selected and harvested for next generation.
- Twenty four F_4 progenies were sown and ten single plant selections were selected and harvested for next generation.

Maize:

For the development of high yielding composite maize variety coupled with better quality, eight populations were raised and after selection of superior plants allowed them to intermating and seeds were obtained for next cycle.

1.	Anand	:	G_1 (African Tall)
2.	Anand	:	G_2 (J-1006)
3.	Rahuri	:	G_1 (African Tall)
4.	Rahuri	:	G_2 (J-1006)
5.	Urulikanchan	:	G_1 (African Tall)
6.	Urulikanchan	:	G_2 (J-1006)
7.	J-1006 x BAIF-245, Pratap makka Chari-6, GWL-15, 3-2-5 (F_5) 1-66-1 (F_5)	:	G_1
8.	African Tall x BAIF-245, Pratap makka Chari-6, GWL-15, 3-2-5 (F_5) 1-66-1 (F_5)	:	G_2

F_3: Twenty F_3 progenies were raised and thirty one superior plants were selected on the basis of morphological characters for next generation.

F_4: Forty four F_4 progenies were raised and seventy three superior plants were selected on the basis of morphological characters for next generation.

***Contribution of entries in AICRP trial**

Sr. No.	Crop	Name of Entry	Name of Trial
1.	Pearl millet	AFB-9 AFB-8	IVTPM AVTPM-1
2.	Maize	AFM-1 AFM-2 AFM-3	IVTM

TNAU, COIMBATORE

Characterization of fodder cowpea germplasm accessions

A total of 80 germplasm accessions were subjected for morphological and biochemical characterization. The accessions were analyzed for five morphological characters and the results on the mean performance of the accessions with respect to the five traits are given below**.**

Based on the *per se* performance, six genotypes *viz*., TNFC 0924, CO (FC) 8, IFC 24094, IFC 95/01, FD 826 and CL 88 were identified as potential parents for utilization in hybridization programme for the improvement of green fodder yield and quality in cowpea. Among the entries, TNFC 0924 was found to be superior in terms of fodder yield as compared to the check CO (FC) 8.

The principal component analysis was performed to establish the importance of different traits in explaining the total variation. The results revealed the presence of eight principal components having eigen values greater than 0.897. These contributed 76.79% of the total variation among fodder cowpea genotypes. Among the eight principal components PC1, PC2 and PC3 were able to distinguish genotypes with variability in fodder yield, seed traits and fodder quality respectively.

The simple matching coefficient and Rogersô distance analyses were used to measure the genetic distance among the fodder cowpea accessions using qualitative traits. Ten clusters were formed by simple matching coefficient analysis and 31 clusters by Rogersô model at 50 % similarity index indicating the existence of appreciable diversity among the germplasm accessions.

Characterization of Guinea grass germplasm accessions

A total of 60 Guinea grass germplasm accessions were subjected for morphological and biochemical characterization. The accessions were analyzed for five morphological characters and the results on the mean performance of the accessions with respect to the five traits are given below (Table 2).

Based on high per se performance and biometrical estimation, two genotypes *viz*., GGLC 12 and GGLC 19 were identified as potential genotypes for use in breeding programme for the improvement of green fodder yield in Guinea grass. The genotypes FD 679 and GGLC 1 were found to be superior with regard to high crude protein with low crude fibre content. These genotypes could be used for the development of nutritive and palatable fodder varieties in Guinea grass.

Mahalanobis D^2 statistics established the presence of high magnitude of genetic divergence among the accessions by formation of ten clusters. The clustering pattern based on Tocherôs method revealed that, genetic diversity in Guinea grass was not fully related to geographical distribution of genotypes. The maximum divergence was contributed by crude fibre content and least by GFY per plant.

The variability of the genotypes was interpreted based on four principal components, the first one described the yield level, the second described the productivity and quality and the last two described the quality of the fodder indicating that the identified traits within the axes exhibited great influence on the phenotype and this could be effectively used for selection among the tested entries.

Multicut fodder sorghum culture identified for release during 2014

A multicut non seed shattering fodder sorghum has been proposed for state release during 2014. It was identified for release as CO 31 by University Technology Release Screening Committee. It was found to possess low HCN content to the tune of 172 ppm at harvesting stage (initiation of flowering) besides high fodder and seed yield.

Special features

- Higher green fodder yield (192 t/ha/year)
- High tillering with long and broad leaves
- Enhanced seed yield due to intact seeds
- High crude protein content (9.86 %) and dry matter yield (49.73 t/ha/yr)
- Low HCN (172 ppm) and crude fibre (19.80 %)
- Superior ratooning ability renders 6-7 harvests per year.
- Highly palatable, preferred by milch cattle, goat and sheep

KAU, Vellayani

Rice bean: Two accessions collected during Kharif 2013 were evaluated along with 5 selected accessions. Two accessions with high green fodder yield, leaf/stem ratio, branch number and tolerance to pests and diseases were selected.

Cowpea: Germplasm collection and evaluation: Five accessions collected during Kharif 2013 were evaluated with five selected accessions. Four accessions with high leaf/stem ratio; green fodder yield and dry matter yield were selected for further evaluation.

National Breeding Programmes

Special Programme for Varietal Improvement in Fodder Rice bean

Collection and evaluation of germplasm

- One accession with high leaf area, leaf density and having more number of branches and green fodder yield selected during Kharif 2012 was evaluated against Bidhan-1and Bidhan 2 during Kharif 2013. Flowering and seed set was very low in all the three accessions and so evaluation will be repeated during kharif 2014.
- Thirteen promising inter varietal crosses of ricebean received from BCKV, Kalyani were evaluated during Kharif 2011, 2012. Flowering and seed set was very low in all the crosses.
- Evaluation of bajra-napier hybrids
- Fifty one bajara-napier hybrids developed at the Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore during Kharif 2010 were evaluated during Kharif 2011. Out of the 51 hybrids sown, 20 hybrids have germinated and they were multiplied. Evaluation of 20 hybrids was done during kharif 2012. Five hybrids with superior fodder attributes were selected for yield trials.

CSKHPKV, Palampur

Germplasm Holding

Crop	No. of collections
Setaria (*Setaria anceps*)	40
Paspalum (*Paspalum wetstenii*)	2
Maize (*Zea mays*)	32

Promising Germplasm

Crop	Entries
Setaria	
Low oxalates	S-6, S-7, S-10, S-13, S-17, S-30, S-33, S-18 and S-20
Frost Tolerance	S-13 and S-20
Leaves/plant	S-1,S-2 and S-6
Leaf-stem ratio	S-9,S-18, S-20 and S-39

Breeding work

Setaria grass

- Based on the evaluation of polycross progenies, six genotypes viz., PS-3, PS-8 and PS-25 were good general combiners for fodder yield and related traits and suitable for development of synthetic varieties for increased fodder yield in Setaria grass.
- Evaluation of thirty one collections against 3 checks revealed superiority of selections S-1, S-16 and S-31for fodder yield and other traits.
- Four new clonal selections were also made.

Maize

- Twenty land races/populations of maize were maintained. Land races PMG 62 and PMG 95 and composites PMG 93-1 and PMG 93-2 gave numerically higher fodder yield but were statistically at par with African tall for fodder yield.

Bajra Napier hybrid programme

- Evaluation of sixteen hybrids revealed superiority of three hybrids, namely, NDFB 7 x FD 464, NDFB 17 x FD 479 for fodder yields.

MPKV, Rahuri

Hybridization programme (Station)

Development of multi cut sorghum: A total 48 Sorghum x sudan grass crosses were attempted during Rabi, 2012-13 using four sweet sorghum CMS lines (viz., 185A, 479A, ICSA-205A and ICSA-206A) and twelve promising sudan grass accessions (viz., IS-722, IS-3214, IS-3225, IS-3238, IS-3267, IS-3289, IS-3307, IS-3309, IS-3312, IS-3323, IS-3351 and IS-3338). These 48 sorghum x sudan grass hybrids were sown in RBD with three replication in two different station trials (24 crosses each) during Kharif 2013 (sowing date 24.6.2013) along with parents and sudan grass check variety COFS-29.

Development of B x N hybrids: The 27 bajra x Napier crosses were effected at Rahuri during Rabi-2012-13. Further, F_1 seed of 56 bajra x Napier crosses developed by Forage Breeder, TNAU, Coimbtore were received for evaluation. Total 83 F_1 seed of bajra x Napier crosses were sown during summer 2013. From these 83 crosses, 272 heterotic clones were selected and sown in augmented block design with check Phule Jaywant on 10.9.2013 for further yield and quality evaluation.

PGR - Germplasm maintained

N	Crop	No. of germplasm
1	Maize	06
2	Bajra	12
3	Sorghum	9
4	Sudan grass	54
5	Napier (*Pennisetum purpereum*)	43
6	Guinea grass (*Panicum maximum*)	11
7	Stylo (*Stylosanthes* spp.) (34- *S. sebrana,* 5 -*S. scabra,* 2- *S. hamata, 1-S. viscosa-1, S. seca)*	43
8	Marvel (*Dichanthium spp.)*	48
9	Madras Anjan (*Cenchrus spp.)*	43
10	Dongari *(Crysopogon fulvus)*	13
11	Rhodes grass (*Choris gayana*)	7
12	Pawana (*Sehima nurvosum*)	2
13	Gokarn/Butterfly pea (*Clitoria ternatea*)	24
14	Dinanath (*Pennisetum pediselatum*)	3
15	Dashrath (*Dasmanthas virgatus*)	2

ANGRAU, Hyderabad

Forage Cowpea:

- 20 cowpea germplasm lines obtained from NBPGR, Regional Station, Hyderabad were evaluated during the season under report.
- The following crosses in F5 generation were advanced to F6 generation.

S.N.	Cross combination	S.N.	Cross combination
1.	CO2 X CO 5	7.	B.L X selection local
2.	CO5 X UPC 5286	8.	CO4 X SK-57
3.	CO4 X SK-58	9.	CO4 X SK-55
4.	CO2 X CS-88	10.	CO4 X selection local
5.	NDFC-6 X B.L	11.	CO4 X B.L
6.	CN 8076 X B.L	12.	CO4 X TPTC-1

Bajra Napier Hybrids:

- 54 Bajra Napier hybrids obtained from AICRP-FC, TNAU, Coimbatore are established at the centre during Rabi, 2012-13. Among the 54 cross combinations 10 were identified promising with high tillering, long plant height, long, broad & soft leaves, glabrous at the nodes.
- Identified 10 promising BN hybrids evaluated in replicated station trial during Kharif 2013.

APPENDIX-I (A)

Other Activities
AICRP FC TNAU, COIMBATORE, TAMIL NADU

Awards and Honours - Dr. C. Babu, Professor, (PBG), Best Researcher Award during 43rd Foundation Day (TNAU) on 01.07.2013

Publications

Research papers: 2

Dhasarathan, M., **C. Babu**, K. Iyanar and K. Velayudham. 2012. Studies on genetic potential of baby corn (*Zea mays* L.) hybrids for yield and quality traits. *Electronic Journal of Plant Breeding*, 3(3): 853-860.

Ramakrishnan, P., **C. Babu** and K. Iyanar. 2013. Genetic variability, character association and path analysis studies in Guinea grass (*Panicum maximum* Jacq.). *Electronic Journal of Plant Breeding*, 4(3): 1265-1270.

Book : 1

Iyanar, K., **C. Babu**, A. Kalamani and **A. Velayutham**. 2013. Theevanapayir Sakupadi**.** Published by Thannambikkai, Coimbatore ï 641 041, p. 99 (**ISBN: 978-93-87702-57-2**)

Book chapters: 5

Important persons visited to AICRP FC centre

- Dr. R. Palanisamy, IAS, Director, Department of Veterinary and Animal Husbandry, Govt. of Tamil Nadu, Chennai
- Thiru. Neethi Mohan, Chairman & Managing Director, Vaigai Agro Products Limited, Madurai
- Dr. K. Krishnamoorthy, Assistant Director (A.H) and Dr. M. Swaminathan, Deputy Director, Cattle Breeding and Fodder Development
- Dr. S. Sathiamoorthy, Former Director, NRC on Banana (ICAR), Trichy.
- Mneme George, Assistant Editor, Karshakashree, Malayala manorama, Kottayam, Kerala
- Dr. Emanuel Emylyanus, Leuver, Belgium

Student(s) guided – M.Sc. -2, Ph.D-1

Details of FTDs conducted - 60

Training conducted for farmers/ NGO/ Govt. officials : 2

TV/ Radio talk delivered by AICRP-FC staff/ extension activities -2

Details of seed/ planting material sold to farmers/ others, interaction with farmers, NGO and Govt. staff

Forage crops seed production details (2013)

S. No.	Forage crops	Total quantity (kg)		
		Foundation seed	TFL seed	Total
1.	Multicut fodder sorghum CO (FS) 29	1642	433	2075
2.	Fodder maize- African tall	2607	3400	6007
3.	Fodder cowpea CO (FC) 8	937	22	959
4.	Hedge Lucerne		46	46
5.	Sithagathi (*Sesbania sesban*)		6.0	6.0
6.	Subabul		6.5	6.5
	Grand Total	**5186**	**3913.5**	**9099.5**

Quantity of planting material produced and supplied (2013)

S. No.	Crop	Planting material (Nos.)
1.	BN hybrid CO (CN) 4	**38,78,885**
2.	Guinea grass CO (GG) 3	**35,000**

Externally funded projects: 3

AICRP FC, NDUAT, FAIZABAD, U.P.

Publications (books, research publications, etc.): 6

Research publications: 3

Popular Articles & Pumphlets for farmers: 3

Ved prakash, D. N. Vishwakarma, Harinarayan Bind, C.N. Ram and Baudh Bharti (2013) Heterosis studies for some forage and grain yield traits in oat (*Avena sativa* L) *Plant Archives*,13(1): 229-233.

Ved Prakash, D.N. Vishwakarma, Harinarayan Bind, C.N. Ram and Baudh Bharti (2013). Combining ability analysis for some fodder traits in oat (*Avena sativa* L.) *Plant Archives* (accepted).

Sachin B. Sinde, Deo Narain Vishwakarma. Amita Sharma, Dhairyashil M, Langade (2013). Inheritance of fodder and yield traits in oat (*Avena sativa L.*) .*Turkish Journal of Field Crops:* 18(2): 151-157.

Students guided: M. Sc. -1

FTDs conducted: 22

T.V./Radio talk delivered: 4

Seed /planting materials sold to farmers /others:

- Root slips of hybrid napier promising line NDHN-9 distributed among 150 farmers
- Seed of forage bajra variety NDFB-2 & root slips of Hybrid Napier promising line NDHN-9 and oat varieties NDO-1 & NDO-2 distributed among farmers.

AICRP FC OUAT, BHUBANESWAR

Publications: 4

Kar, C. S., Bastia, D. K. and Tripathy, S (2013) System productivity and soil health in relation to microbial population in organic rice-rice sequence. *Journal of Crop and Weed.* 9(2): 102-108.

Bastia, D. K., Tripathy, S. Barik, T., Kar, C. S. Raha, S. and Tripathy, A. (2013) Yield and soil organic carbon sequestration under organic nutrient management in rice rice system. *Journal of Crop and Weed.* 9 (1): 52-55.

Dash, G.B. Muduli,K.C. and Misra,R.C. (2013) Micromutational variability and its exploitation for isolating High Fodder Yielding Mutants in Rice Bean. *J. Crop Sci. Biotech.*2013 (June)16(2):1-7.

Dash,G. B. (2012) Variability and character association studies among micromutants of forage rice bean. *Forage Research.* 38 (2).119-121.

Symposium/ seminar: 2

Student(s) guided : M. Sc - 1

FTDs conducted: 21

TSP activities: Major activities under TSP is intensification of promoting cultivation of forage crops among tribals in Koraput, Kandhamal, Keonjhar and Gajapati districts. In these districts tribal farmers have been selected and supplied rooted slips of HNB and other inputs. Detailed classroom trainings and field training has been imparted

Training conducted for farmers/ NGO/ Govt. Officials: 3

TV/ Radio talk delivered by AICRP-FC staff/ extension activities: 1

AICRP FC SKUAST, SRINAGAR

Publications

Research Paper

Ahmad, M., Zaffar, G., Mir, S.D., Dar, Z.A., Iqbal, S., and Habib, M. 2014. Genetic analysis for fodder yield and its important traits in oats (*Avena sativa* L.). *Indian Journal of Genetics and Plant Breeding*. 74(1):1-3

Ahmad M., Zaffar G., Razvi S.M., Dar Z.A., Khan M.H. and Ganie S.A. 2013. Combining ability study in oat (*Avena sativa* L.) for physiological, quality traits, forage and grain yield. *African Journal of Agriculture Research*, 8(43): 5245-5250

Ahmad, M., Zaffar G.(2014). Evaluation of oat (*Avena sativa* L.) genotypes for beta-glucan, grain yield and physiological traits. *Applied Biological Research*. 16(1):1-3

Ahmad, M., Zaffar, G., Razvi, SM, Mir, SD., Rather, MA and Dar, ZA.(2013).Gene action and combining ability for fodder yield and its attributing traits in oats (*Avena sativa* L.). *Scientific Research and Essays.* 8(48):2306-2311

Ahmad A., Zaffar G., Razvi SM., Mir SD and Rather MA. (2013). Stability properties of certain oats genotypes for major grain yielding characteristics. *International Journal of Plant Breeding and Genetics.* pp1-6

Ahmad A., Zaffar G., Mir SD., Dar ZA., Dar SH., Iqbal S., Bukkhari SA., Khan GH., Gazal A (2013) Estmation of correlation coefficient in oats (*Avena sativa* L.) for forage yield, grain yield and their contributing traits. *International Journal of Plant Breeding and Genetics.* pp1-4

Ahmad, M., Zaffar, G., S.D. Mir, Shahida Iqbal and Z.A. Dar .(2013). Combining ability studies in oats (*Avena sativa* L.) for seed yield. *Applied Biological Research*. 15(2): 1-6

Ahmad, M. and Zaffar, G. (2014).Stability analysis for forge yield and its contributing traits in Oats (*Avena Sativa* L.).*Trends in Bioscience*. (Accepted)

Ahmad, M. and Zaffar, G. (2014).Study of heterosis, inter-relationship and path analysis of green fodder yield and its contributing traits in oats (*Avena Sativa* L.). *Research Journal of Agriculture Sciences.* (Accepted)

Students Guided- M.Sc.-1, Ph.D-1

FTDs conducted- 10

TSP activities- Distributed Oats seed, Vermi-compost and farm implements to 50 Tribal farmers of Anderwan, Choontwaliwar villages of Ganderbal District under Tribal Sub Plan scheme in the month of November-2013

Training conducted for farmers/ NGO/ Govt. officials-3

Forage seed produced: 108 q Breeder seed, 4040 q ï Foundation seed, 2868 Q ï TFL seed

AICRP FC, CAU, IMPHAL

Student(s) guided- M. Sc. 1

Details of FTDs conducted- 10 nos. of FTDs on fodder rice bean and fodder maize was conducted during *kharif* 2013

TSP activities- TSP on ñIncome Generation and Livelihood Security of Tribal Farmers in Hilly Areas of Manipurò was successfully conducted during the year 2013-14

Details of seed/planting materials sold to farmers/others, interaction with farmers, NGO and Govt. staff Interaction programme with farmers on ñProduction of fodder rice bean and maize under rainfed conditions of Manipurò was organized during *kharif* 2013 and time to time interaction was also done with the govt. staff of Department of Animal Husbandry for the development of dairy farmers of Manipur.

AICRP FC, ANGRAU, HYDERABAD

Publications

- **Research papers:** 7
- **Book Chapter** -1
- **Popular articles in vernacular language:** 2
  Conference proceedings as abstracts: 2

T. Shashikala, K.N Rai R.Balaji Naik , M.Shanti, V.Chandrika and K.Loka Reddy 2013. Fodder potential of multicut pearl millet genotypes during summer season. *International Journal of Bio-resource and stress management.* 4 (4)

T. Shashikala, Kamala venkateshan, M. Shanthi, R. Balaji Naik and V. Chandrika 2013. Phenotypic quantitative characters association with fodder yield in Cowpea *Vigna unguiculata (L). Journal of Research, ANGRAU*

T.Shashikala,R.Balaji Naik ,M.Shanti,K.B.Sunitha Devi V.Chandrika and K.Loka Reddy 2014. Forage resources of Andhra Pradesh and Research Technology of Forage Crops. *International Journal of Bio-resource and stress management.* 5(1) Mar 2014 Accepted

R. Balaji Naik, V. Chandrika, T.Shashikala, K. B. Suneethadevi and M.Shanti 2013. Evaluation of forage production potential of maize grown for baby corn and green cob. *Progressive Agriculture* 14(1): Accepted.

T.Shashikala,. R.Balaji Naik, M. Shanti. R.Susheela.V. Chandrika and K.Loka Reddy. 2013 Fodder Performance of different Oat (*Avenasativa L.*,) genotypes under Agro climatic conditions of Telangana state. *Progressive Agriculture* 14(1): Accepted.

M.Shanti, R.Balaji Naik, T.Shashikala and Dr.K.Loka Reddy. 2013. Study On Forage Quality Of Various Maize Cultivars Produced under Different Use Patterns *Forage Research* 37 : 234-237

Student guided - M. Sc. -1
FTDs conducted - 20
TSP activities - 1.00 lakh

- 10 families of Petralchen, AmrabadMandal, Mahaboobnagar Distt . grown fodder Bajra and APBN-1 during *Kharif* 2013.
- 10 families of Tellapallivillage,PanagalMandal ,MahaboobnagarDistt. have been identified for forage demonstration during *Rabi*-2013

Training conducted for farmers/NGOs/ govt officials -2
HRD -1
Training : Dr. M. Shanti had a fourteen day training programme on ñClimate change, Carbon sequestration and Carbon trading in Agricultureò from August 23rd to 5th September, 2013 at Indian Institute of Soil Science, Bhopal.

TV/ radio talk delivered / extension activities -4
Seed/ planting material sold farmers/ others.

Crop / variety	Seed / Planting material
APBN-1	37,000 slips
CO-4	7,000 slips
Sorghum var. PC-23	94 kgs
Bajra var Giant bajra	21 kgs
Sorghum var SSG-59-3	15 kgs

AICRP FC, JNKVV JABALPUR

Awards and Honours: Jabalpur centre was conferred ñcertificate of Appreciation ñ for its significant contributions in the field of research and development at National Group Meeting held during 10-11 Mat,2013 at Assam Agricultural University, Jorhat (Assam).

Publications (books, research papers, bulletins etc.) - 1

Important persons visited

- Board Members of Vishwa Vidyalaya
- Dr. Swapan K. Datta , DDG ICAR and other dignitaries
- Dr. Arvind Kumar DDG, Education ICAR along with other dignitaries
- Dr. S.K. Patil , Ex Director IARI and other dignitaries

Student(s) guided ï M.Sc. -1
FTDs conducted- 30
TSP activities

- Twenty Six farmer families of Kanhiasang (Distt. Dindori) has been identified for forage demonstration. And the seeds of improved variety of Maize, rice bean and Hybrid Napier have been distributed to them.

TV/ Radio talk / extension activities- one
Details of seed/ planting material sold to farmers/ others : Sorghum (3.0q) Maize (05q) Berseem (11.4q) and Oat (89.0q)

AICRP FC, ASSAM AGRICULTURAL UNIVERSITY, JORHAT

Publication: Research paper/article -2
Extension bulletin- 2
Important persons Visited:

- Dr S K Datta, DDG(CS), ICAR, New Delhi
- Dr R. P.Dua, ADG(FFC), ICAR, New Delhi
- Dr P. K. Ghosh, Director, IGFRI, Jhansi

Student Guided : 4
FTD conducted – 44 farmers in 5 districts on Hybrid napier and Setaria
TSP activities: 20 farmers in Karbi Anglong district.

- Crops demonstrated and rooted slip supplied on Hybrid napier variety Co-3 and Setaria variety PSS-1
- As entry point activities two trainings were conducted and 60 sapling of Assam lemon were distributed.
- Two chaff cutter to be given to village.
- Two animal health camp will be conducted

Training Conducted: 9
TV/Radio talk : 4
Seed / planting materials sold to farmers

Name of Grass	Qty	Value
Hy.Napier	27000.00	13500.00
Setaria	39000.00	19500.00
Congosignal	32000.00	16000.00
Guinea	15000.00	7500.00
Total	113000.00	55500.00

Externally funded project - 1

AICRP FC, BCKV, KALYANI,

Publications

Alipatra, C. K. Kundu, M. K. Mandal, H. Banerjee and P. Bandopadhyay 2013. Yield and quality improvement in fodder oats (Avena sativa L.) through split application of fertilizer and cutting management. *Journal of Crop and Weed* 9(2): 193-195

Bulletin - 1
Student(s) guided: M. Sc. ï 3, Ph. D. - 6
FTDs conducted: 40
Training conducted for farmers/NGO/Govt. officials : 3
Seed/planting materials sold to farmers/ others: Bidhan Rice bean ï 1 to NDRI, E.R.S (Kolkata)
Externally funded project: 1

AICRP FC, AAU, ANAND

Publications
Popular articles : 9
Symposium/ seminar: 4
Student(s) guided: M. Sc. : 1
FTDs conducted - 21
HRD: Dr. D.H. Desai Participated on ñUP gradation of Communication Skillò held for 13.05.13 to 18.05.13 at EEI, Anand (Gujarat).
TV/ Radio talk / extension activities -5

Seed/ planting material sold to farmers/ others

- *Bajra* Var. GFB-1: 255kg;
- Sorghum Var. S-1049 : 244 kg
- rooted slips : 16,87,500 Nos.

AICRP FC, CCS HAU, HISAR

Publications (books, research papers, bulletins etc.): 1
Research Paper
M. K. Jat, O. P. Chaudhary, H. D. Kaushik, Y. Jindal and A. S. Tetarwal 2013. Diversity and Abundance of Different Floral Visitors on Eigyption Clover, *Trifolium Alxendranium* L. Forage Research 38 (4)

Student(s) guided: M.Sc. -1

FTD conducted: 15

AICRP FC, PAU, LUDHIANA

Publications

Research Papers - 8

Lambay, G. K., Upasana Rani, U. S. Tiwana and R. K. Bajaj. 2012. Screening of sorghum genotypes against leaf spots. *Crop Improvement* **39** (Special Issue) : 933-934.

Rani U., Bhardwaj R., Singh D P and Bajaj R K. 2012. Evaluation of pearl millet CMS lines against diseases. *Crop Improvement* **39** (special issue): 1717

Tiwana, U. S., Raman Kumar and M. S. Bhillar. 2012. Weed control in newly planted Napier-bajra hybreid (*Pennisetum glaucum x P. Purpureum)*. *Crop Improvement* **39** (Special Issue): 1079-1080.

Tiwana, U. S. and Ajaib Singh. 2012. Effect of oat + sarson mixture on the productivity and quality of fodder mixture and seed yield of oat under different cutting management. 2012. *Range Mgmt. & Agroforestry* **33** (2): 177-181.

Tiwana, U. S., Upasana Rani, D. P. Chaudhary and Pritpal Singh. 2012. Seed yield and mosaic of cowpea CL 367 as influenced by sowing time, row spacing and seed rate. *Progressive Research* 7 (Special): 227-230.

Tiwana U S, Chaudhary D P and Rani U. 2012. Evaluation of cereal fodders and Sesbania intercropping through forage productivity, quality, economics and competitive ability under various row proportions, *Progressive Research-An International Journal* **8** (special):78-82.

Rahul Kapoor, Ravi Kant Bajaj and T.P. Singh 2012. Correlation and path coefficient analysis for fodder yield and related traits in Napier bajra hybrid [*Pennisetum americanum* x *Pennisetum purpureum* Schumach] under multicut regime In: *Sandhu et al (eds) Proc. International Conference on Sustainable Agriculture for Food and Livelihood Security,* November 27-29, 2012, Ludhiana, India: Crop Improvement Vol 39 (Spl. Issue), p 425-426.

Rahul Kapoor and Ravi Kant Bajaj (2013) Combining ability and heterosis studies in fodder oats (*Avena sativa* L.) for green fodder yield and component traits. *Vegetos* 26(1) 272-77.

Seminar/ Symposium – 12
Extension/ teaching manuals - 7
Student(s) guided: M. Sc. – 6 ; Ph. D.- 2
Fodder Technology Demonstrations conducted – 80

Training conducted for farmers/ NGO/ Govt officials -18
HRD for the AICRP-FC staff – 2 , Dr. Rahul Kapoor

- Efficient utilization of wild and exotic wheat germplasm facilitated by molecular markers and doubled haploidy
- Nanotechnology for Agricultural Research

TV/ Radio talk delivered by AICRP-FC staff/ extension activities -21
Seed/ planting material sold to farmers/ others: J 1006 (Maize), FBC 16 (Bajra), PGG 518 (Guinea grass) and PBN 233 (Napier bajra hybrid) by Director of seeds, PAU,

AICRP FC MANDYA CENTER, KARNATAKA

Research paper: 1

- Effect of Phosphorus levels on forage yield of fodder Cowpea. 2013, *Journal of Horticulture letters* 2 (1): 12-13

Bulletins: 2

- Forage production technologies
- Training Manual on fodder developments & Production technologies

Important person Visited

- Minister of Agriculture, Karnataka state.
- Member of Parliament of Constituency.
- Member of Legislature.
- Vice chancellor, UAS Bangalore.
- Directorate of Extension & Directorate of Research UAS Bangalore.
- Honourable Board Members UAS Bangalore.
- Principle Secretary, Agriculture & Horticulture Karnataka state Government.
- Krishi mission president, Karnataka state Government.

Students Guided-3

FTD is conducted- 30

Training Conducted for farmers ï 8

TV/ Radio talk delivered - 3

Seed / planting materials sold:

- 10qt Breeder seed of Fodder Maize variety African tall
- 3qt Breeder seed of Fodder Cowpea variety KBC-2
- 50000 (Root slips) of Hybrid Napier CO-3 to farmers
- 10 Kg TL seed of Sorghum COFS-29
- 25000 (Root Slips) of Guinea grass variety JHGG 08-1

Externally Funded Project: 1

AICRP FC, CSKHPKV, PALAMPUR

Awards and Honours

- DBT- CREST AWARD, Department of Biotechnology, Ministry of Science & Technology, Govt. of India, for the year 2012.
- ñHonored by United States Department of Agriculture (USDA)ò for cloning of genes from ricebean for Hessian fly resistance in wheat in 2012.
- First Prize for the poster presentation in National Seminar on ñIndian Agriculture: Present situation, challenges, remedies and road mapò by YSD at CSK HPKV Palampur, August 4-5, 2012

Publications : 5
Research Paper

Rajan Katoch, M. Thakur., and Naveen Kumar .(2012). Effect of morphological stage and clipping intervals on quality and digestibility of tall fescue (*Festuca arundinacea* Schreb. and *Setaria* (*Setaria anceps* Stapf.) *Range Mgmt. & Agroforestry*. 33(2) 185-192.

Rajan Katoch. (2013). Nutritional evaluation, protein digestibility and profiling of different *Vigna* spp. *Indian J Agri. Biochem*. 26(1), 32-35.

Rajan Katoch, M. Thakur, Naveen Kumar and J.C. Bandhari (2012). Golden Timothy ï Present status and future perspectives in North-West Himalayas. *Range Mgt. & Agroforestry*. 33(1) 1-7.

Naveen D, B R Sood, Naveen Kumar and V K Sharma 2012. Forage production and soil fertility as affected by introduction of high yielding species in dry temperate pastures of north western Himalaya. *Range Management & Agroforestry* 33 (1):73

S K Sandal, K Saini, A Kumar and Naveen Kumar .(2013) Effect of fertiliser recommendations and tillage manipulation on productivity and nutrient uptake of rainfed wheat (*Triticum aestivum)* in an Alfisol. *Agropedology* Vol. 22(2):56-59

Seminar/ Symposium - 5
Book - A.S Kapoor, and D. K.Banyal, 2012. Plant Disease Epidemiology and Management. Narendra Publishing House. ISBN 978-93-80428-69-7. 160P
Extension Bulletin: 1

Student(s) guided: M.Sc – 6 ; Ph.D- 3
Fodder Technology Demonstrations: *Kharif* 2013 conducted - 32
TSP activities – 1.00 lakh, 20 families in Sangla & Spiti valley
Training conducted for farmers/ NGO/ Govt officials -2
HRD for the AICRP-FC staff

- National Seminar on ñIndian Agriculture: Present situation, challenges, remedies and road mapò by YSD at CSK HPKV Palampur, August 4-5,2012
- International Agronomy Congress, IARI New Delhi, Nov. 26-30,2012

TV/ Radio talk delivered / extension activities -2

Seed/ planting material sold to farmers/ others

Species	Seedlings	Seed (kg)
Setaria grass	2217975	30
Napier - *bajra* hybrid	227800	-
Temperate grasses	285000	5
White clover	-	5

Externally funded project- 4

AICRP FC, MPKV, RAHURI

Student guided: M.Sc.-5
Teaching:- M.Sc.-2
FTD conducted:25
Training conducted for farmers/NGO/Govt. officials: Organized 2 days training
TSP activities: Rs. 1.0 lakh. About 12 beneficiary farmers from Nandurbar District are selected

AICRP FC, VELLAYANI, THIRUVANANTHAPURAM

Publications

- Leaflets (2)- Guinea grass and Hybrid napier (Malayalam)

FTDs conducted- 25

HRD: Dr Usha C Thomas, Assistant Professor(Agronomy) had attended 2 day training on ôWTO and free trade agreements- Challenges, Issues andOppurtunities in the Agriculture sectorô during December 19-20,2013.

Seed/ planting material sold: Planting material- for Rs. 37,000/-

AICRP FC SKRAU, BIKANER

Publications (books, research papers, bulletins etc): 3

Research papers:

- Kumar, Mahender and S. S. Shekhawat (2013) Genetic variability in barley (*Hordeum vulgare* L.). *Electronic Journal of Plant Breeding* , **4**(4): 1309-1312.
- Kumar, Mahender and S. S. Shekhawat (2013) Correlation and path coefficient studies in barley (*Hordeum vulgare* L.). *Electronic Journal of Plant Breeding*, **4**(4): 1313-1318.
- Meena, K. K., R.S.Meena and S.M.Kumawat (2013) Effect of sulphur and iron fertilization on yield attributes, yield and nutrient uptake of mungbean (*Vigna radiata). Indian Journal of Agricultural Sciences* **83** (4):472-6.

Student (s) guided: M.Sc.-2, Ph.D.-1
FTDs conducted: 40
raining conducted for farmers/ NGO/Govt. officials: 2
HRD for the AICRP FC Staff: Dr. S. S. Shekhwat attended one day Workshop on ñDisaster Management for Animals ï Challenges and Strategiesò
Seed /planting material sold: 15000 kg green fodder, @ Rs. 0.50 per kg
Externally funded projects: Two

APPENDIX-II

WEATHER REPORT FOR KHARIF 2013

The Weather reports of the AICRP-FC Coordinating, Cooperating and Volunteer centres across different zones during Kharif 2013 programme have been presented in this section. The weather parameters from 26th Standard Meteorological Week (June 25, 2013) to 44th Standard Meteorological Week (October 29-November 04, 2013) were taken into consideration, which covers the *Kharif 2013* season for all the testing locations for trial conduction [Table MET- 1.1 (a) to 1.4 (n)]. During the reporting period, weather variations are clearly visible in maximum and minimum temperature, rainfall, rainy days and sunshine hours in different agro-climatic zones, which have wide impact on establishment, growth, yield and quality of different forage crops and their varieties. The weather parameters have also shown close correlation with the incidence and surveillance of insect-pest and disease of forage crops. Weather parameters influenced the establishment, growth and performance of different annual and perennial forage crops and their varieties.

Temperature

In Hill Zone, Srinagar remained the coolest location recording 1.3^{0}C during 44th SMW. Maximum temperature was also recorded at Srinagar i.e. 33.7^{0}C during 31st SMW. The average minimum temperature over the season was also recorded lowest at Srinagar. In North-East zone, Imphal recorded the lowest minimum temperature (13.2^{0}C) during 44th SMW followed by Ranchi (13.5^{0}C) during same week and maximum temperature was recorded at Faizabad (35.0^{0}C) during 36th SMW followed by Kalyani (34.8^{0}C) during 27th SMW. Minimum variation for maximum temperature over the season was observed at Bhubaneswar followed by Jorhat. In North-West Zone, Bikaner recorded lowest minimum temperature (13.1^{0}C) during 44th SMW followed by Hisar (14.2^{0}C) during same week. Maximum temperature was recorded at Bikaner (41.0^{0}C) during 26th SMW.

In Central Zone, Kanpur recorded the lowest minimum temperature (12.8^{0}C) during 44th SMW followed by Jhansi (14.3^{0}C) during the same week. The maximum temperature was recorded at Jhansi (35.3^{0}C) during 37th SMW followed by Anand (35.1^{0}C) during same week and Rahuri recorded lower minimum temperature over the season as compared to rest of the locations. The minimum fluctuation in maximum temperature over the season was at Urulikanchan and Rahuri locations. In South zone, the lowest minimum temperature was recorded at Mandya (17.0^{0}C) during 40th SMW followed by Hyderabad (17.5^{0}C) during 44th SMW. The maximum temperature was recorded at Hyderabad viz., 34.3^{0}C during 27th SMW followed by Coimbatore (33.1^{0}C during 35th SMW). Hyderabad experienced higher maximum temperature over the crop season as compared to other locations in the Zone and minimum fluctuation in minimum and maximum temperature was observed at Vellayani.

Rainfall

The average annual rainfall of India is about 1192 mm and 80-90 percent rainfall in the country is mostly contributed through South-West Monsoon. During kharif season some of the states receive very less amount of rainfall specially J & K, Tamil Nadu and Karnataka as evident from the rainfall data. In Hill Zone, Palampur received higher rainfall (2200mm) followed by Almora (504 mm in 58 rainy days) and lowest being with Srinagar (95.8 mm). In North East Zone, Bhubaneswar received highest rainfall (1533.5 mm) followed by Jorhat (1143.4mm) and lowest being with Imphal (161 mm). Maximum number of rainy days was recorded at Jorhat (90 days) followed by Kalyani (89 rainy days) and lowest being with Faizabad (45 rainy days).

In North-West Zone, Pantnagar received highest rainfall (1307.2 mm) followed by Hisar (594.3 mm). Bikaner received lowest rainfall (202.6 mm) in just 16 rainy days followed by Jodhpur (389.9 mm). In Central Zone, maximum rainfall (2182.5 mm) was received at Jabalpur followed by Raipur (1397.2 mm) and lowest being with Urulikanchan (408.7mm in 32 rainy days). Maximum

number of rainy days was also observed at Jabalpur (60 RD) followed by Raipur (59 RD) and lowest being with Rahuri (27RD). In South Zone, Vellayani received maximum rainfall (721.3 mm) in 54 rainy days followed by Hyderabad (697.6 mm in 39 RD) and lowest total rainfall was with Coimbatore (278.1 mm in 19 RD). In the same zone the well distribution of rainfall was observed at Vellayani and Hyderabad (evident from rainy days).

Relative Humidity

In hill Zone, the morning RH was highest at Almora (100 % during 44th SMW) followed by Palampur (98.0 % during 32nd SMW). Whereas, the afternoon RH was also recorded lowest at Almora (34.3% and 36.9 % during 44th and 43rd SMW, respectively). Morning RH was recorded higher throughout the crop season at Almora as compared to Palampur and Srinagar. In North-East Zone, maximum RH of 98.0% was recorded at Bhubaneswar (during 43rd and 38th SMW) and Kalyani (in 40th SMW) during morning hours. Minimum RH during morning hours was recorded at Faizabad (79.2% in 43rd SMW) followed by Rachi (81.6% in 27th SMW). However, the average RH was recorded highest at Bhubaneswar i.e., 95.5 % during 43rd SMW.

In North-West Zone, RH ranged from 57.5 to 96.0 % in morning hours and between 17.2 to 81.0% in afternoon. The lowest RH during morning hours was at Bikaner (57.5%) during 43rd SMW, whereas, highest morning and afternoon RH was recorded at Hisar (96.0 and 81.0 %, respectively) during 33rd SMW. Lower values of afternoon RH over the season was observed at Bikaner followed by Jodhpur. In Central Zone, maximum RH in morning hours (100 %) was recorded at Urulikanchan during 29th SMW and lowest RH (63.0%) in morning was observed at Rahuri centre during 44th SMW. Maximum afternoon RH (94.9%) was recorded at Urulikanchan during 29th SMW. In South Zone, the maximum RH (98.6%) was recorded in the morning hours at Vellayani during 37th SMW. The minimum fluctuation in the morning RH was recorded at Mandya. The lowest afternoon RH was recorded at Hyderabad (46.0%) during 29th SMW.

Sunshine hours

In Hill Zone, sunshine hours were recorded maximum at Srinagar (9.9 during 27th SMW) followed by 8.6 h in 34th SMW at the same location. In the same zone, over the season the maximum sunshine (6.8h) was also recorded higher at Srinagar as compared to Palampur (4.8h) and Almora (5.1h). In North-West Zone, sunshine hours were recorded highest at Bikaner (10.7h and 10.6 h in 36th and 35th SMW, respectively) followed by Hisar (10.0h in 36th SMW). On mean basis Bikaner and Hisar recorded maximum sunshine hours (7.9 and 7.3h, respectively) followed by Jodhpur (7.2h) and lowest being with Ludhiana (6.5h). In North-East Zone, Jorhat recorded maximum sunshine hours (9.3 h) followed by Ranchi (9.2 h). Maximum average sunshine hours over the season were recorded at Ranchi (5.5 h) followed by Faizabad (5.2 h) and Jorhat (5.1h). Bhubaneswar experienced lowest sunshine hours over the season as compared to other locations.

In Central Zone, the maximum sunshine hours were recorded at Anand and Jhansi (10 h each during 43rd and 36th SMW, respectively). On mean basis the maximum sunshine hours was recorded at Anand and Jhansi (5.5h each) followed by Jabalpur (4.8h) and lowest being with Raipur (3.8h). In South Zone maximum sunshine hours was recorded at Coimbatore (9.1 h) followed by Hyderabad (9.0 h), whereas, on mean basis over the season Coimbatore recorded maximum sunshine hours (5.3h) followed by Hyderabad (4.7h) and lowest being with Mandya (4.1h).

Table MET -1.1 (a): Temperature (^{0}C) during crop growth period, Kharif 2013

Met. Week	Hill Zone						North West Zone									
	Palampur		Almora		Srinagar		Ludhiana		Bikaner		Jodhpur		Hisar		Pantnagar	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
26	26.9	19.5	28.8	20.8	30.4	16.2	34.7	26.8	41.0	28.0	37.8	29.9	39.6	28.4	31.1	25.2
27	26.3	19.8	26.6	21.1	32.4	15.2	35.0	28.5	40.5	25.5	37.1	27.2	38.7	27.5	32.3	25.3
28	27.1	19.1	29.3	21.4	32.2	16.4	35.0	27.1	39.3	25.3	36.5	27.3	35.7	26.5	32.4	26.3
29	25.8	19.8	27.6	21.5	30.5	16.4	34.0	27.5	39.0	25.5	35.9	27.2	36.1	26.4	31.3	25.5
30	26.2	19.4	29.2	21.1	30.2	16.8	35.4	28.3	34.5	21.8	34.0	25.8	35.3	27.1	32.4	25.6
31	26.7	20.1	30.4	21.1	33.7	16.9	33.9	26.9	36.2	22.7	33.1	26.1	34.6	26.9	33.0	26.0
32	23.8	19.6	29.1	20.6	27.8	15.3	32.1	26.4	35.5	22.2	33.5	26.3	32.7	25.9	32.1	25.3
33	24.6	18.6	29.6	20.2	25.7	17.7	31.2	25.6	33.3	21.6	31.3	25.1	31.7	25.5	31.5	24.5
34	27.0	19.0	30.2	20.6	31.2	18.7	34.8	26.8	37.0	23.5	34.3	25.8	33.6	26.1	33.6	25.9
35	26.9	18.3	29.5	19.9	30.7	17.7	34.4	26.4	36.0	23.7	34.2	25.1	35.3	25.3	31.2	25.2
36	26.2	16.9	29.6	18.4	27.7	16.3	34.0	25.6	36.3	24.6	34.3	24.3	35.2	23.7	32.1	23.6
37	26.3	16.3	29.5	17.6	22.7	14.4	34.1	24.4	39.2	25.1	38.8	27.0	36.5	24.6	33.4	23.6
38	27.4	15.2	30.4	17.3	26.8	13.5	33.6	22.6	36.8	24.2	38.1	24.3	32.8	22.4	32.8	23.8
39	26.9	16.2	29.4	19.1	25.3	9.0	33.0	23.5	33.4	22.0	31.0	24.4	32.7	24.5	33.0	24.1
40	24.6	15.9	27.1	17.7	24.5	6.9	32.1	24.0	35.6	22.3	33.2	25.1	31.3	23.6	30.3	23.1
41	24.2	16.7	28.0	16.9	22.0	4.7	30.6	23.3	34.7	22.0	34.9	24.0	32.0	23.6	31.2	22.1
42	25.3	12.6	27.2	13.4	19.1	4.3	32.8	18.6	35.9	18.2	36.5	20.9	33.2	19.0	30.4	20.1
43	23.7	11.8	27.1	10.9	17.5	4.9	30.7	16.9	34.6	15.1	34.7	18.0	31.4	16.3	30.2	16.8
44	22.8	9.7	25.4	5.7	17.1	1.3	28.1	13.8	33.3	13.1	32.8	17.6	30.3	14.2	30.2	18.8

Table MET -1.1 (b): Temperature (^{0}C) during crop growth period, Kharif 2013

Met. Week	North East Zone											
	Faizabad		Imphal		Bhubaneswar		Kalyani		Jorhat		Ranchi	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
26	30.0	24.7	30.1	22.8	33.2	25.9	32.8	26.2	33.1	25.3	27.6	21.3
27	32.5	25.7	29.2	22.6	33.5	25.9	34.8	26.2	33.1	25.4	28.4	21.9
28	32.3	26.5	30.6	22.3	33.7	25.4	34.0	26.6	33.2	25.7	28.6	22.6
29	34.1	27.0	32.8	22.9	31.8	25.4	33.9	26.7	32.4	26.0	30.9	23.8
30	33.5	26.7	30.6	22.5	30.7	25.2	31.5	26.2	32.5	25.4	27.9	20.5
31	34.2	26.4	31.4	22.5	31.5	24.7	34.2	26.3	32.4	25.5	28.0	21.2
32	32.9	25.4	29.9	21.2	31.5	25.3	31.4	25.8	33.8	25.3	29.9	21.9
33	34.2	24.9	31.0	22.1	33.2	25.2	33.0	26.1	33.6	26.1	30.2	22.2
34	34.0	26.4	31.6	22.1	32.5	25.5	33.2	26.3	31.1	25.3	27.2	20.8
35	31.7	25.0	29.9	22.5	32.0	24.9	32.2	25.7	32.6	25.9	28.4	21.1
36	35.0	25.7	29.9	22.0	32.1	24.4	34.0	25.8	32.1	24.5	30.4	22.6
37	34.1	24.8	31.5	21.0	33.7	24.8	34.1	26.2	29.9	24.2	30.4	22.4
38	33.8	24.9	30.8	21.1	31.6	23.8	34.5	26.0	28.6	24.1	29.5	22.1
39	33.1	25.3	29.0	21.3	32.5	24.3	34.5	26.2	28.3	24.1	30.8	21.8
40	29.0	23.5	29.6	20.1	31.7	23.9	32.3	24.9	29.2	24.0	26.1	19.6
41	30.6	23.8	29.5	17.0	31.4	23.9	31.4	24.9	29.4	23.1	26.7	19.8
42	28.9	21.6	32.3	19.8	32.1	23.2	33.0	24.5	30.4	20.5	24.9	18.6
43	31.1	18.7	26.5	17.4	26.7	21.8	28.3	22.8	29.8	19.0	25.1	19.0
44	29.6	17.3	27.2	13.2	31.2	19.1	32.8	19.7	29.5	16.5	26.2	13.5

Table MET -1.1 (c): Temperature (^{0}C) during crop growth period, Kharif 2013

Met. Week	Central Zone													
	Kanpur		Urulikanchan		Anand		Rahuri		Raipur		Jabalpur		Jhansi	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
26	30.6	22.7	27.5	24.2	34.4	26.8	31.2	22.4	30.4	24.9	29.3	23.3	33.6	24.5
27	32.2	23.8	28.7	24.7	32.4	25.6	31.4	23.0	31.3	24.5	29.2	23.5	31.3	25.0
28	32.4	23.7	26.5	23.4	31.8	25.1	29.9	22.7	31.2	24.3	30.5	24.0	33.0	25.3
29	32.4	24.1	25.8	22.9	31.0	25.5	23.8	21.8	30.5	25.3	31.1	24.3	32.6	25.3
30	33.3	24.1	25.8	22.9	29.9	25.3	29.0	22.5	28.4	24.7	29.2	23.6	32.0	25.9
31	33.8	24.5	26.4	23.2	29.2	24.8	28.2	21.9	28.3	23.9	30.0	23.9	31.7	24.8
32	32.4	26.0	27.6	23.9	30.6	24.8	29.6	21.8	31.1	24.7	28.7	23.6	31.1	25.0
33	32.4	22.9	29.0	24.4	31.2	25.0	30.2	22.1	31.3	24.3	29.4	23.2	31.6	24.7
34	33.8	24.4	27.8	23.8	30.8	24.8	29.2	21.8	27.9	23.8	27.9	23.3	31.4	24.9
35	30.9	23.0	30.0	24.3	32.7	24.7	31.5	20.4	29.3	24.5	28.5	23.2	31.0	23.6
36	33.6	22.9	30.5	24.8	33.4	24.7	32.3	19.7	31.1	24.8	31.4	23.1	34.2	23.3
37	33.6	22.4	31.3	24.6	35.1	25.4	31.4	22.0	31.9	25.2	32.6	23.7	35.3	24.5
38	33.6	22.3	28.9	24.1	34.4	25.7	29.6	21.5	29.9	24.1	26.6	20.0	34.1	24.1
39	33.2	22.3	29.6	23.9	29.1	24.4	30.5	21.1	32.0	24.9	31.8	23.4	33.6	24.4
40	28.5	20.6	30.6	25.8	32.9	25.0	31.9	21.2	30.1	24.1	28.9	22.9	29.1	23.1
41	30.9	20.3	31.9	25.1	31.2	23.7	31.1	20.0	30.2	23.3	29.7	21.8	30.9	22.9
42	31.3	17.8	32.0	25.4	36.0	23.1	32.0	20.1	30.7	21.4	30.1	18.4	32.6	20.1
43	31.0	16.2	31.2	25.5	35.0	19.4	31.2	19.6	28.8	22.6	29.4	18.8	31.6	16.7
44	31.2	12.8	31.2	24.5	34.4	17.9	31.4	16.8	30.5	17.3	30.7	15.4	32.6	14.3

Table MET -1.1 (d): Temperature (^{0}C) during crop growth period, Kharif 2013

Met. Week	South Zone									
	Vellayani		Mandya		Coimbatore		Hyderabad		Dharwad	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
26	29.9	23.3	29.9	19.3	30.5	23.1	32.1	24.5	27.3	20.6
27	29.3	23.4	29.7	19.4	31.0	23.0	34.3	23.7	26.7	20.6
28	28.5	23.0	29.3	19.4	30.0	23.0	30.9	23.0	25.5	20.3
29	28.3	23.5	29.1	19.3	29.5	23.7	33.5	24.2	25.7	20.7
30	29.4	21.9	28.7	19.3	29.6	23.1	30.9	25.0	23.9	20.1
31	29.0	21.6	28.2	18.9	29.6	22.6	27.8	21.6	25.0	46.2
32	28.8	23.9	29.9	19.5	30.9	22.2	29.0	22.2	27.3	20.0
33	28.6	23.7	28.2	19.3	31.4	22.3	28.1	22.1	26.3	20.5
34	29.8	24.0	29.4	18.9	32.0	22.6	29.2	22.0	26.3	19.5
35	30.2	24.4	31.4	19.5	33.1	22.9	30.2	21.4	29.4	19.3
36	28.8	23.7	29.9	19.4	30.7	22.3	31.5	21.2	28.6	20.0
37	28.7	23.4	28.5	20.1	30.3	22.7	31.4	20.7	28.0	20.8
38	28.8	24.3	29.8	18.6	30.4	24.1	29.9	20.5	27.2	20.7
39	30.2	24.0	29.9	17.6	32.3	21.4	31.5	19.9	26.5	19.6
40	30.5	22.6	29.6	17.0	32.4	20.9	30.5	22.0	27.5	20.0
41	30.6	23.3	30.1	18.2	32.3	22.3	31.1	20.8	29.2	19.4
42	30.7	23.7	30.4	19.5	31.4	22.2	31.8	17.7	30.3	19.4
43	30.7	23.0	29.5	18.9	29.8	21.3	26.3	19.4	27.8	20.0
44	30.7	23.6	29.5	19.4	31.1	22.6	30.1	17.5	25.4	17.7

Table MET -1.2 (e): Rainfall (RF, mm) and Rainy days (RD, No.) during crop growth period, Kharif 2013

Met Week	Hill Zone				North West Zone							
	Palampur	Almora		Srinagar	Ludhiana		Bikaner		Jodhpur		Hisar	Pantnagar
	RF	RF	RD	RF	RF	RD	RF	RD	RF	RD	RF	RF
26	71.2	73.5	5	0.0	53.8	3	0.0	0	0.0	0	0.0	287.0
27	284.2	70.0	5	0.0	12.6	1	12.1	1	40.8	1	51.5	154.8
28	57.2	42.2	6	0.0	31.5	2	0.0	0	1.5	0	65.7	37.2
29	193.6	49.5	4	0.8	2.2	0	40.0	1	29.9	2	30.5	97.8
30	199.0	28.0	6	0.0	34.4	0	26.8	4	83.6	3	0.0	95.8
31	205.4	45.5	5	0.0	78.4	2	5.0	1	3.4	1	69.0	44.0
32	307.0	47.0	5	14.0	66.8	2	42.0	2	30.8	1	76.5	175.6
33	132.6	26.5	4	19.4	130.6	0	51.4	3	54.8	3	154.2	187.8
34	149.6	2.0	0	0.0	4.5	1	19.3	3	0.0	0	0.0	12.4
35	125.7	37.5	3	0.0	3.2	1	0.0	0	0.0	0	0.0	43.8
36	71.0	7.0	2	0.0	12.2	2	0.0	0	0.0	0	0.0	5.2
37	32.8	17.0	2	38.0	0.0	0	0.0	0	0.0	0	0.0	34.0
38	117.2	13.5	2	0.0	0.0	0	5.0	1	14.0	1	114.5	5.4
39	103.0	31.0	6	15.0	25.3	1	1.0	0	130.3	4	25.9	33.2
40	84.8	7.0	1	0.0	22.4	0	0.0	0	0.6	0	4.0	6.8
41	49.7	3.0	1	0.0	1.2	0	0.0	0	0.2	0	2.5	79.6
42	16.6	4.0	1	0.0	0.0	0	0.0	0	0.0	0	0.0	0.0
43	0.0	0.0	0	0.0	0.0	0	0.0	0	0.0	0	0.0	0.0
44	0.0	0.0	0	8.6	12.0	1	0.0	0	0.0	0	0.0	6.8

Table MET -1.2 (f): Rainfall (RF, mm) and Rainy days (RD, No.) during crop growth period, Kharif 2013

Met. Week	North East Zone									
	Faizabad		Imphal	Bhubaneswar		Kalyani		Jorhat		Ranchi
	RF	RD	RF	RF	RD	RF	RD	RF	RD	RF
26	312.3	6	11.0	48.8	4	86.5	6	125.6	4	18.8
27	25.6	3	7.9	41.9	3	12.6	3	184.1	6	10.2
28	32.0	4	15.6	28.2	4	31.6	4	47.4	6	23.9
29	31.8	3	2.7	96.3	5	21.2	5	75.6	5	0.0
30	5.0	2	6.6	72.4	6	104.7	7	64.8	6	102.4
31	77.4	2	10.8	27.4	4	19.5	6	43.5	7	20.0
32	47.6	6	14.4	43.5	5	55.5	5	140.1	6	2.0
33	41.6	6	17.7	55.1	5	34.1	5	13.2	4	32.2
34	20.1	2	8.8	2.6	1	134.7	5	99.5	6	212.7
35	24.0	3	10.9	51.6	4	86.5	6	41.2	4	30.4
36	0.0	0	8.2	73.0	3	68.0	6	59.1	3	0.0
37	42.0	3	20.0	44.9	3	39.0	3	100.8	7	39.2
38	8.4	1	1.3	133.9	6	37.9	4	29.5	7	39.3
39	74.0	2	12.2	93.8	4	72.9	3	34.6	6	20.7
40	3.6	1	2.0	50.5	6	46.6	7	54.5	7	154.6
41	3.1	1	4.6	298.4	5	85.8	5	29.7	5	155.7
42	0.0	0	0.1	14.2	2	31.6	4	0.0	0	26.6
43	0.0	0	4.9	357.0	7	76.5	5	0.2	1	21.0
44	0.0	0	1.3	0.0	0	0.0	0	0.0	0	0.0

Table MET -1.2 (g): Rainfall (RF, mm) and Rainy days (RD, No.) during crop growth period, Kharif 2013

Met. Week	Central Zone													
	Kanpur		Urulikanchan		Anand		Rahuri		Raipur		Jabalpur		Jhansi	
	RF	RD	RF	RD	RF	RD	RF	RD	RF	RD	RF	RD	RF	RD
26	268.2	7	11.8	2	0.0	0	16.6	1	41.0	3	232.4	5	125.8	4
27	42.0	3	16.8	2	106.0	3	18.8	1	73.5	3	42.2	3	99.4	5
28	44.0	4	38.8	4	161.3	6	8.6	1	144.4	5	214.1	6	61.8	3
29	123.1	5	31.9	4	52.0	6	65.2	5	44.6	5	150.7	5	139.2	5
30	103.8	2	31.4	4	172.2	5	22.8	2	88.2	4	122.1	6	153.2	7
31	49.9	2	28.8	4	79.4	4	21.2	2	255.8	5	38.9	5	151.4	4
32	59.6	6	0.0	0	68.0	4	1.0	0	87.4	4	210.2	4	170.2	5
33	25.4	5	0.0	0	164.7	2	2.6	1	177.0	5	687.6	5	83.6	5
34	0.0	0	0.0	0	18.6	2	13.4	1	60.5	4	184.3	5	80.2	5
35	65.0	4	0.0	0	0.3	0	0.0	0	120.8	3	57.2	3	68.4	3
36	0.0	0	38.6	2	62.4	3	54.0	1	54.8	4	86.8	2	0.0	0
37	14.4	2	116.0	6	3.8	0	46.6	5	11.6	1	0.0	0	9.6	1
38	27.4	1	75.6	2	45.4	5	45.8	2	92.6	4	46.2	3	22.2	3
39	39.0	2	0.0	0	288.8	2	0.0	0	28.6	1	6.0	2	11.0	2
40	143.2	4	19.0	2	1.4	2	28.2	1	45.2	5	69.0	3	102.0	3
41	0.0	0	0.0	0	18.7	1	65.8	3	8.6	1	18.4	2	5.6	1
42	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
43	0.0	0	0.0	0	0.0	0	5.2	1	32.6	2	16.4	1	0.0	0
44	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0

Table MET -1.2 (h): Rainfall (RF, mm) and Rainy days (RD, No.) during crop growth period, Kharif 2013

Met. Week	South Zone								
	Vellayani		Mandya		Coimbatore		Hyderabad		Dharwad
	RF	RD	RF	RD	RF	RD	RF	RD	RF
26	34.2	3	0.0	0	14.8	1	33.5	3	24.8
27	33.5	4	4.6	1	0.2	0	63.0	2	27.0
28	60.8	4	1.2	0	5.6	0	23.8	2	27.8
29	60.5	6	14.0	1	12.6	1	23.4	1	36.8
30	69.8	5	16.4	1	3.5	0	24.0	1	85.6
31	92.8	4	6.3	0	7.4	0	28.5	4	59.6
32	7.8	1	15.4	1	12.8	1	54.4	3	18.4
33	3.1	0	0.0	0	5.5	1	72.8	5	13.0
34	3.0	0	0.0	0	0.0	0	1.4	0	20.6
35	2.4	0	5.0	1	21.5	1	9.0	1	11.6
36	118.0	6	101.2	3	10.4	2	8.6	1	14.8
37	36.9	4	52.8	2	15.6	1	45.5	2	97.0
38	36.6	4	2.8	1	0.6	0	56.5	5	15.8
39	2.3	0	0.0	0	0.0	0	0.0	0	8.2
40	13.4	2	0.0	0	0.0	0	2.0	0	10.2
41	22.8	2	0.0	0	10.0	2	18.0	2	0.0
42	7.0	2	86.0	3	93.4	4	11.2	1	17.6
43	54.4	3	30.0	2	34.6	2	222.0	6	47.6
44	62.0	4	3.4	1	29.6	3	0.0	0	0.0

Table MET- 1.3 (i): Relative humidity (M = Morning, AN = Afternoon, AV = Average; %) during crop growth period, Kharif 2013

MetWeek	Hill Zone									North-West Zone														
	Palampur			Almora			Srinagar			Ludhiana			Bikaner			Jodhpur			Hisar			Pantnagar		
	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV
26	89.3	85.4	87.4	94.8	74.1	84.5	76.0	49.5	62.8	82.0	60.0	71.0	59.3	36.0	47.7	64.0	42.0	53.0	70.6	39.9	55.3	91.6	71.6	81.6
27	92.9	89.9	91.4	92.1	81.6	86.9	75.5	40.4	58.0	82.0	64.0	73.0	66.0	37.4	51.7	80.0	49.0	64.5	78.1	55.0	66.6	90.6	73.1	81.9
28	90.9	82.3	86.6	96.1	68.6	82.4	76.8	50.3	63.5	81.0	64.0	72.5	77.4	44.8	61.1	78.0	52.0	65.0	82.6	60.9	71.8	87.0	70.7	78.9
29	97.6	92.9	95.3	92.8	67.2	80.0	78.4	56.0	67.2	84.0	65.0	74.5	70.0	51.7	60.9	79.0	56.0	67.5	84.4	67.1	75.8	90.7	77.0	83.9
30	96.4	86.1	91.3	92.0	72.6	82.3	76.7	48.7	62.7	82.0	63.0	72.5	85.0	63.8	74.4	91.0	66.0	78.5	85.4	59.0	72.2	85.4	68.6	77.0
31	93.7	86.9	90.3	90.4	66.1	78.3	75.0	44.2	59.6	83.0	72.0	77.5	81.2	56.5	68.9	87.0	64.0	75.5	86.9	67.1	77.0	87.0	68.0	77.5
32	98.0	94.7	96.4	94.3	66.6	80.5	80.7	56.1	68.4	94.0	73.0	83.5	82.7	43.0	62.9	85.0	61.0	73.0	92.0	76.0	84.0	91.0	74.0	82.5
33	95.3	89.4	92.4	91.7	61.1	76.4	85.5	60.8	73.2	91.0	75.0	83.0	91.6	69.7	80.7	92.0	73.0	82.5	96.0	81.0	88.5	88.0	73.0	80.5
34	94.1	82.9	88.5	90.1	64.5	77.3	80.5	46.8	63.7	90.0	63.0	76.5	79.8	48.1	64.0	81.0	54.0	67.5	91.4	68.7	80.1	87.0	65.0	76.0
35	94.1	83.1	88.6	93.6	72.6	83.1	78.5	48.2	63.4	86.0	59.0	72.5	75.3	42.1	58.7	78.0	47.0	62.5	77.7	55.3	66.5	93.0	73.0	83.0
36	83.6	81.3	82.5	97.1	59.5	78.3	72.8	43.5	58.2	84.0	68.0	76.0	70.0	36.5	53.3	74.0	44.0	59.0	77.6	46.7	62.2	91.0	69.0	80.0
37	84.7	83.9	84.3	92.4	65.3	78.9	90.2	72.5	81.4	85.0	57.0	71.0	58.8	29.8	44.3	61.0	35.0	48.0	83.6	44.0	63.8	85.0	62.0	73.5
38	77.0	63.9	70.5	96.9	55.1	76.0	80.3	67.4	73.8	89.0	55.0	72.0	75.8	35.8	55.8	73.0	47.0	60.0	88.1	58.1	73.1	81.0	65.0	73.0
39	88.9	76.6	82.8	94.1	56.1	75.1	88.0	52.3	70.1	88.0	62.0	75.0	83.1	52.7	67.9	84.0	68.0	76.0	90.1	70.1	80.1	89.0	62.0	75.5
40	93.1	82.6	87.9	95.7	60.3	78.0	82.1	48.2	65.2	89.0	63.0	76.0	82.0	47.4	64.7	79.0	50.0	64.5	89.1	62.7	75.9	82.0	67.0	74.5
41	88.6	88.1	88.4	95.8	61.1	78.5	85.8	40.2	63.0	95.0	67.0	81.0	78.0	39.4	58.7	78.0	42.0	60.0	91.6	58.9	75.3	90.0	61.0	75.5
42	78.6	60.3	69.5	94.6	52.2	73.4	86.3	65.2	75.8	89.0	35.0	62.0	61.8	29.4	45.6	72.0	25.0	48.5	86.7	37.3	62.0	91.0	63.0	77.0
43	90.3	70.1	80.2	96.9	36.9	66.9	83.8	60.7	72.3	91.0	38.0	64.5	57.5	24.7	41.1	63.0	22.0	42.5	94.9	36.9	65.9	88.0	55.0	71.5
44	72.7	43.9	58.3	100	34.3	67.2	88.0	49.5	68.8	87.0	37.0	62.0	61.8	17.2	39.5	63.0	30.0	46.5	89.1	37.1	63.1	85.0	53.0	69.0

Table MET- 1.3 (j): Relative humidity (M = Morning, AN = Afternoon, AV = Average ;%) during crop growth period, Kharif 2013

Met. Week	North-East Zone																	
	Faizabad			Imphal			Bhubaneswar			Kalyani			Jorhat			Ranchi		
	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV
26	93.2	82.4	87.8	89.7	77.3	83.5	90.0	76.0	83.0	96.0	88.6	92.3	92.3	72.3	82.3	84.0	70.1	77.1
27	85.0	72.2	78.6	90.4	79.6	85.0	92.0	80.0	86.0	94.1	75.4	84.8	91.6	70.7	81.2	81.6	63.7	72.7
28	87.2	74.0	80.6	93.3	75.3	84.3	94.0	76.0	85.0	94.0	80.0	87.0	93.1	75.4	84.3	82.4	63.0	72.7
29	85.8	65.7	75.8	89.7	71.4	80.6	92.0	87.0	89.5	94.6	81.0	87.8	94.1	77.4	85.8	81.9	69.9	75.9
30	85.2	65.0	75.1	93.9	74.1	84.0	95.0	88.0	91.5	97.3	88.4	92.9	94.4	75.4	84.9	82.3	67.3	74.8
31	84.1	59.7	71.9	93.6	75.7	84.7	93.0	81.0	87.0	95.6	77.6	86.6	92.0	74.6	83.3	82.4	70.1	76.3
32	83.1	62.2	72.7	92.1	82.1	87.1	96.0	83.0	89.5	97.3	92.0	94.7	94.3	71.3	82.8	83.7	71.7	77.7
33	85.7	62.1	73.9	93.1	73.7	83.4	93.0	73.0	83.0	96.0	76.1	86.1	91.3	72.1	81.7	83.1	67.3	75.2
34	84.5	65.5	75.0	95.0	71.4	83.2	90.0	72.0	81.0	96.3	79.9	88.1	94.4	82.7	88.6	83.3	68.3	75.8
35	92.4	69.7	81.1	91.6	77.7	84.7	95.0	77.0	86.0	97.0	81.6	89.3	94.3	76.7	85.5	82.3	71.6	77.0
36	82.8	57.0	69.9	91.6	75.7	83.7	95.0	76.0	85.5	96.6	81.0	88.8	92.3	72.7	82.5	82.4	69.7	76.1
37	88.8	60.2	74.5	93.7	74.0	83.9	94.0	77.0	85.5	94.7	72.4	83.6	96.3	88.1	92.2	85.9	68.0	77.0
38	84.7	62.8	73.8	92.1	73.0	82.6	98.0	80.0	89.0	95.4	76.0	85.7	94.3	84.7	89.5	83.4	67.7	75.6
39	85.9	64.4	75.2	88.6	77.6	83.1	96.0	75.0	85.5	93.7	71.3	82.5	94.1	85.4	89.9	87.4	65.6	76.5
40	84.8	69.1	77.0	89.0	72.9	81.0	96.0	76.0	86.0	98.0	79.9	89.0	94.7	87.1	90.9	84.7	69.3	77.0
41	88.2	72.4	80.3	91.7	66.9	79.3	97.0	81.0	89.0	96.0	83.3	89.7	93.4	81.3	87.4	84.1	63.9	74.0
42	94.1	70.5	82.3	87.9	63.0	75.5	95.0	75.0	85.0	96.9	75.1	86.0	89.6	67.3	78.5	84.3	70.9	77.6
43	79.2	59.5	69.4	93.1	76.3	84.7	98.0	93.0	95.5	97.4	85.3	91.4	92.0	63.7	77.9	81.7	68.3	75.0
44	86.8	61.0	73.9	88.0	51.4	69.7	91.0	44.0	67.5	94.7	57.4	76.1	92.9	61.0	77.0	83.6	69.1	76.4

Table MET- 1.3 (k): Relative humidity (M = Morning, AN = Afternoon, AV = Average ;%) during crop growth period, Kharif 2013

Met. Week	Central Zone																	
	Urulikanchan			Anand			Rahuri			Raipur			Jabalpur			Jhansi		
	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV
26	99.9	91.9	95.9	91.0	66.0	78.5	73.0	56.0	64.5	88.0	73.0	80.5	92.0	88.0	90.0	91.0	72.0	81.5
27	95.3	83.4	89.4	94.6	75.0	84.8	78.0	61.0	69.5	90.0	70.0	80.0	89.0	75.0	82.0	93.0	76.0	84.5
28	98.1	89.1	93.6	96.1	78.1	87.1	78.0	69.0	73.5	93.0	78.0	85.5	93.0	81.0	87.0	93.0	78.0	85.5
29	100	94.9	97.4	95.0	80.3	87.7	90.0	85.0	87.5	95.0	74.0	84.5	95.0	79.0	87.0	96.0	82.0	89.0
30	99.7	94.7	97.2	98.7	90.6	94.7	84.0	67.0	75.5	92.0	85.0	88.5	93.0	84.0	88.5	96.0	80.0	88.0
31	98.7	91.1	94.9	95.6	88.6	92.1	81.0	70.0	75.5	95.0	84.0	89.5	93.0	78.0	85.5	96.0	81.0	88.5
32	97.4	84.4	90.9	97.9	79.6	88.8	79.0	64.0	71.5	93.0	76.0	84.5	95.0	80.0	87.5	96.0	83.0	89.5
33	96.7	82.9	89.8	98.7	80.4	89.6	78.0	59.0	68.5	95.0	80.0	87.5	95.0	80.0	87.5	95.0	81.0	88.0
34	92.6	80.3	86.4	94.3	76.9	85.6	79.0	64.0	71.5	92.0	84.0	88.0	96.0	83.0	89.5	94.0	77.0	85.5
35	99.6	77.9	88.7	92.9	61.9	77.4	78.0	50.0	64.0	95.0	80.0	87.5	94.0	81.0	87.5	95.0	78.0	86.5
36	96.0	75.4	85.7	96.3	58.9	77.6	79.0	50.0	64.5	93.0	76.0	84.5	92.0	64.0	78.0	91.0	59.0	75.0
37	99.9	86.9	93.4	92.7	60.9	76.8	82.0	60.0	71.0	92.0	73.0	82.5	89.0	63.0	76.0	88.0	56.0	72.0
38	96.4	83.7	90.1	89.7	70.7	80.2	84.0	60.0	72.0	93.0	77.0	85.0	80.0	62.0	71.0	93.0	64.0	78.5
39	99.4	83.1	91.3	97.0	83.6	90.3	80.0	56.0	68.0	93.0	68.0	80.5	90.0	57.0	73.5	89.0	58.0	73.5
40	92.1	73.6	82.9	97.9	71.0	84.5	82.0	58.0	70.0	95.0	75.0	85.0	95.0	77.0	86.0	94.0	83.0	88.5
41	97.0	74.7	85.9	98.4	73.6	86.0	77.0	57.0	67.0	89.0	71.0	80.0	93.0	72.0	82.5	92.0	67.0	79.5
42	97.9	70.1	84.0	84.4	43.9	64.2	75.0	46.0	60.5	91.0	56.0	73.5	95.0	50.0	72.5	90.0	52.0	71.0
43	95.9	69.0	82.4	81.6	36.3	59.0	68.0	56.0	62.0	96.0	73.0	84.5	94.0	60.0	77.0	91.0	47.0	69.0
44	98.7	72.9	85.8	93.9	45.3	69.6	63.0	48.0	55.5	92.0	38.0	65.0	91.0	36.0	63.5	82.0	35.0	58.5

Table MET- 1.3 (l): Relative humidity (M = Morning, AN = Afternoon, AV = Average ;%) during crop growth period, Kharif 2013

Met. Week	South Zone												
	Vellayani			Mandya			Hyderabad			Dharwad			Coimbatore
	M	AN	AV	M	AN	AV	M	AN	AV	M	AN	AV	M
26	90.0	80.2	75.1	87.0	50.0	68.5	79.1	57.6	68.4	93.6	75.7	84.7	84.0
27	93.9	85.1	89.5	85.0	59.0	72.0	84.1	57.4	70.8	94.7	74.4	84.6	81.0
28	93.7	79.6	86.7	90.0	58.0	74.0	85.3	63.7	74.5	94.6	81.0	87.8	84.0
29	94.0	87.9	91.0	90.0	68.0	79.0	78.3	46.0	62.2	94.6	84.3	89.5	73.0
30	92.3	88.0	90.2	87.0	63.0	75.0	81.4	60.6	71.0	95.4	87.9	91.7	80.0
31	93.1	87.0	90.1	88.0	60.0	74.0	86.1	77.9	82.0	94.6	84.9	89.8	79.0
32	96.7	82.7	89.7	91.0	58.0	74.5	89.0	66.1	77.6	93.7	78.3	86.0	89.0
33	93.3	78.4	85.9	89.0	58.0	73.5	89.7	77.6	83.7	94.7	79.0	86.9	88.0
34	92.7	78.7	85.7	90.0	56.0	73.0	91.7	77.3	84.5	91.9	78.9	85.4	81.0
35	86.6	80.1	83.4	89.0	54.0	71.5	90.6	80.4	85.5	80.0	48.9	64.5	90.0
36	97.0	86.7	91.9	91.0	54.0	72.5	87.6	61.0	74.3	93.7	73.1	83.4	90.0
37	98.6	84.0	91.3	87.0	74.0	80.5	87.0	62.0	74.5	94.9	72.9	83.9	89.0
38	96.3	85.4	90.9	87.0	50.0	68.5	90.0	70.0	80.0	95.1	75.4	85.3	76.0
39	93.7	85.1	89.4	88.0	53.0	70.5	84.0	60.0	72.0	93.7	76.6	85.2	84.0
40	94.0	74.4	84.2	87.0	54.0	70.5	84.0	63.0	73.5	92.7	73.0	82.9	82.0
41	91.4	75.4	83.4	88.0	55.0	71.5	87.0	62.0	74.5	92.7	59.1	75.9	85.0
42	92.1	79.9	86.0	91.0	52.0	71.5	87.0	53.0	70.0	90.1	50.1	70.1	94.0
43	95.0	70.9	83.0	93.0	55.0	74.0	96.0	81.0	88.5	92.4	73.1	82.8	92.0
44	93.9	80.1	87.0	91.0	59.0	75.0	87.0	56.0	71.5	86.6	49.6	68.1	89.0

Table MET -1.4 (m): Sunshine at AICRP-FC trial locations during crop growth period, Kharif 2013

Met. Week	Hill Zone			North West Zone			
	Palampur	Almora	Srinagar	Ludhiana	Bikaner	Jodhpur	Hisar
26	8.0	3.0	8.7	7.8	7.7	8.3	6.8
27	3.0	1.5	9.9	4.0	6.0	5.7	6.9
28	5.0	4.4	7.8	7.2	7.5	4.3	7.8
29	1.9	2.3	7.3	5.3	6.7	7.1	5.5
30	4.2	4.5	8.1	8.7	6.0	4.1	7.6
31	2.7	5.5	8.1	6.0	6.7	3.9	7.0
32	0.6	3.7	6.1	5.7	3.5	3.2	4.5
33	0.8	4.9	3.4	4.2	5.1	4.4	7.1
34	4.0	4.9	8.6	6.5	9.8	9.4	5.9
35	4.6	4.4	5.4	9.2	10.6	8.7	9.9
36	5.6	6.0	5.9	7.9	10.7	9.9	10.0
37	5.7	6.9	2.6	8.7	8.8	9.3	9.1
38	8.5	6.9	8.3	8.7	9.0	8.6	7.3
39	6.5	5.5	8.2	6.7	9.0	3.7	6.3
40	4.4	3.4	7.0	4.8	8.2	8.4	6.9
41	1.2	6.3	7.1	2.1	8.4	9.3	5.8
42	8.4	7.4	4.8	9.1	9.3	9.5	8.9
43	7.6	8.1	4.8	5.2	9.1	9.6	6.8
44	8.0	7.3	7.1	5.7	8.7	8.8	7.7

Table MET -1.4 (n): Sunshine at AICRP-FC trial locations during crop growth period, Kharif 2013

Met. Week	North East Zone						Central Zone					South Zone		
	Faizabad	Imphal	Bhubaneswar	Kalyani	Jorhat	Ranchi	Kanpur	Anand	Raipur	Jabalpur	Jhansi	Mandya	Hyderabad	Coimbatore
26	2.2	2.1	3.7	1.1	5.2	3.4	1.8	5.4	1.4	2.0	3.1	4.6	1.5	3.7
27	5.6	1.6	1.5	7.1	5.5	4.5	3.9	1.6	4.4	3.9	3.4	2.7	6.5	3.5
28	4.2	3.0	5.9	5.8	4.1	6.5	4.9	1.3	3.9	2.9	4.7	2.3	2.6	2.6
29	5.7	4.5	1.8	5.6	3.0	5.6	4.0	2.1	2.3	3.0	2.6	2.3	5.0	1.8
30	6.5	1.7	1.1	2.2	3.1	3.4	6.0	0.5	0.7	3.0	3.6	3.2	3.9	2.2
31	7.0	3.7	2.6	6.8	6.4	3.9	7.4	0.5	1.3	3.5	5.0	3.4	3.5	4.4
32	5.7	2.9	1.2	1.5	7.4	5.2	1.7	2.7	3.3	3.1	2.4	5.0	5.7	4.5
33	6.5	2.8	3.7	5.3	6.7	5.0	4.3	2.3	3.3	3.0	3.5	1.0	2.2	4.4
34	5.3	4.6	3.1	5.5	7.4	3.1	6.1	2.3	1.5	3.1	3.7	5.5	3.4	8.9
35	1.4	3.9	3.4	3.9	4.1	5.0	2.3	7.0	3.1	4.1	2.8	6.0	3.6	7.0
36	7.2	4.5	2.4	4.3	6.0	7.5	8.0	7.3	4.2	7.2	10.0	3.7	4.8	5.5
37	6.2	4.5	4.9	6.5	0.7	8.1	7.0	8.9	6.2	7.9	9.3	3.8	6.0	4.1
38	7.5	4.3	1.7	6.2	2.2	7.3	8.6	6.6	2.5	3.5	6.7	5.7	2.9	5.3
39	5.7	3.4	3.1	4.8	2.1	8.7	6.7	1.3	6.3	5.9	8.3	5.3	9.0	9.1
40	3.8	2.7	3.5	3.9	1.3	3.8	3.4	6.3	4.2	6.6	2.7	4.8	4.8	9.0
41	3.6	5.5	2.6	4.0	4.2	4.4	7.0	5.1	3.5	5.5	5.9	4.7	6.4	7.3
42	4.2	7.9	3.4	6.7	8.7	5.0	6.1	8.9	8.6	8.3	8.8	3.2	8.1	5.8
43	6.7	1.6	0.5	1.9	8.8	4.0	8.3	10.0	2.1	6.8	8.7	3.6	1.4	4.2
44	4.6	8.0	5.0	8.4	9.3	9.2	6.3	8.4	8.9	8.3	8.8	7.2	7.4	8.1

Met. Week		Met. Week	
26	June 25-July 01,2013	**36**	Sep. 03-Sep. 09, 2013
27	July 02-July 08, 2013	**37**	Sep. 10-Sep. 16, 2013
28	July 09-July 15, 2013	**38**	Sep. 17-Sep. 23, 2013
29	July 16-July 22, 2013	**39**	Sep. 24-Sep. 30 2013
30	July 23-July 29, 2013	**40**	Oct. 01-Oct. 07, 2013
31	July 30-Aug. 05, 2013	**41**	Oct. 08-Oct. 14, 2013
32	Aug. 06-Aug 12, 2013	**42**	Oct.15-Oct. 21, 2013
33	Aug. 13-Aug. 19, 2013	**43**	Oct. 22-Oct.28, 2013
34	Aug. 20-Aug. 26, 2013	**44**	Oct. 29-Nov. 04, 2013
35	Aug. 27-Sep. 02, 2013		

APPENDIX-III:FORAGE CROPS BREEDING TRIALS AT A GLANCE :(KHARIF-2013)

Conté .

Name of Location	Maize		Pearl millet		Cowpea		Rice bean	Napier hybrid (Perennial)	Sehima (Perennial)
	IVTM	AVTHM-1	IVTPM	AVTPM-1	IVTC	AVTC-1	IVT	VTBN-2013 (1st Year)	VT Sehima-2013(1st Year)
HZ	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Palampur	DR	DR	-	-	DR	-	-	A	-
2. Srinagar	DR	DR	-	-	DR	-	-	-	-
3. Almora	DR	DR	-	-	-	-	-	A	-
NWZ									
4. Ludhiana	DR	DR	DR	-	DR	-	-	A	A
5. Hisar	DR	DR	DR	-	DR	-	-	A	A
6. Bikaner	-	-	DR	-	DR	-	-	A	A
7. Jalour	DR	-	DR	-	DR	-	-	-	-
8. Pantnagar	DR	-	-	-	DR	-	-	-	-
9. Udaipur	DR	DR	-	-	DR	-	-	-	-
10. Fetehpur /Shekhawati	-	-	-	-	-	-	-	-	-
11. Jodhpur									
12. Jaisalmer									
13. Pali									
NEZ									
14. Faizabad	DR	DR	DR	DR	DR	DR	-	-	-
15. Ranchi	DR	DR	DR	DR	DR	DR	DR	A	A
16. Kalyani	-	-	-	DR	DR	DR	DR	-	A
17. Bhubaneswar	DR	DR	DR	DR	DR	DR	DR	A	A
18. Jorhat	DR	DR	-	DR	DR	DR	DR	A	-
19. Imphal	-	-	-	DNR	-	-	DR	-	-
20.Pusa	-	-	DR	DR	-	DR	DR	-	-
21. Shillong	-	-	-	-	-	DNR	DNR	-	-
CZ									
22.Anand	DR	-	DR	-	DR	-	-	A	DR
23. Raipur	DR	-	-	-	-	-	DR	-	-
24. Jabalpur	DR	-	DR	-	-	-	DR	A	A
25. Rahuri	DR	-	DR	-	DR	-	-	A	A
26. Urulikanchan	DR	-	DR	-	DR	-	-	A	A
27. Jhansi	DR	-	DR	-	DR	-	-	A	A
28. Aurangabad	-	-	-	-	-	-	-	-	-
29. Jamnagar	-	-	DR	-	-	-	-	-	-
30. Dhari	-	-	-	-	-	-	-	-	-
31. Kanpur	-	-	-	-	DR	-	-	-	-
32. Palghar (Dapoli)	-	-	-	-	-	-	DR	A	-
SZ									
33. Hyderabad	DR	-	DR	-	DR	DR	-	A	A
34. Coimbatore	DR	-	DR	-	DR	DR	-	A	A
35. Mandya	DR	-	DR	-	DR	DR	-	A	A
36. Karaikkal	DR	-	DR	-	DR	DR	-	-	-
37. Dharwad	-	-	-	-	DR	DR	-	A	A
38. Vellayani	-	-	-	-	DR	DR	DNR	-	-
Total	22/22	10/10	18/18	6/7	24/24	12/13	9/11	0/18	1/15

Note: Trial no. 8,9,10, 11, and 12 are perennial in nature and this year was establishment year, therefore not included in data reporting (%).

Name of Location	Dichanthium (Perennial)	Cenchrus Ciliaris (Perennial)	Clitoria (Perennial)	Sewan Grass	Cenchrus setigerus
	VT Dichanthium-2013(1st Year)	VT Cenchrus ciliaris-2013(1st Year)	VT Clitoria-2013 (1st Year)	VT Sewan-2010 (4th Year)	Cenchrus setigerus-2010(4th Year)
	10	**11**	**12**	**13**	**14**
HZ					
1. Palampur	-	-	-	-	-
2. Srinagar	-	-	-	-	-
3. Almora	-	-	-	-	-
NWZ					
4. Ludhiana	A	A	DR	-	-
5. Hisar	A	A	A	-	-
6. Bikaner	A	A	DR	DR	DR
7. Jalour	-	-	-	DNR	DR
8. Pantnagar	-	-	-	-	-
9. Udaipur	-	-	-	-	-
10. Fatehpur /Shekhawati	-	-	-	DNR	-
11. Jodhpur	-		-	DR	DR
12. Jaisalmer	-	-	-	DNR	DNR
13. Pali	-	-	-	-	-
NEZ					
14. Faizabad	-	-	-	-	-
15. Ranchi	A	-	-	-	-
16. Kalyani	A	-	-	-	-
17. Bhubneswar	A	-	-	-	-
18. Jorhat	-	-	-	-	-
19. Imphal	-	-	-	-	-
20. Pusa	-	-	-	-	-
21. Shilong	-	-	-	-	-
CZ					
22. Anand	DR	DR	DR	-	DR
23. Raipur	-	-	-	-	-
24. Jabalpur	A	A	DR	-	-
25. Rahuri	A	A	DR	-	DR
26. Urulikanchan	A	A	A	-	-
27. Jhansi	DR	DR	DR	-	DR
28. Aurangabad	-	-	-	-	-
29. Jamnagar	-	-	-	-	-
30. Dhari	-	-	-	-	DNR
31. Kanpur	-	-	-	-	-
32. Dapoli	-	-	-	-	-
SZ					
33. Hyderabad	A	A	-	-	-
34. Coimbatore	A	A	-	-	DR
35. Mandya	A	A	-	-	-
36. Karaikkal	-	-	-	-	-
37. Dharwad	A	-	-	-	-
38. Vellayani	-	-	-	-	-
Total	2/15	2/11	6/8	2/5	7/9

DR ï Data Reported
DNR- Data not reported
DataReporting(%)=92.4

APPENDIX IV: FORAGE CROP PRODUCTION TRIALS AT A GLANCE: (Kharif-2013)

Location/ Trial	AST -1	AST -2	AST -3	AST -4	AST -5	AST -6	AST -7	AST -8*	AST -9	AST -10	AST -11	AST -12	AST -13	AST -14	AST -15	AST -16	AST -17	AST -18	AST -19	AST -20*	AST -21	AST -22	Total (DR&TC)/ Alloted
HILL ZONE																							
Palampur	TC	DR																					2/2
Srinagar																DR	DR						2/2
NORTH WEST ZONE																							
Hisar	TNC							*															0/1
Ludhiana	TC	DR						*											TC	DR	DR		5/5
Bikaner			DR			TC		*															2/2
Pantnagar	TC																						1/1
NORTH EAST ZONE																							
Faizabad	TC										TC												2/2
Ranchi	TC			TNC			TC																2/3
Kalyani	TC			TNC																			1/2
Bhubaneswar	TC			DR	TC		TC																4/4
Jorhat	TC			DR	TC				TC			DR											5/5
Imphal													DR	DR									2/2
Shillong										TNC													0/1
Raipur								*	TC														1/1
CENTRAL ZONE																							
Jabalpur	TC			DR			TC																3/3
Rahuri	TC	DR				TC																	3/3
Urulikanchan	TC		DR			TC																	3/3
Anand	TC	DR	DR			TC																	4/4
Jhansi			TNC																				0/1
SOUTH ZONE																							
Hyderabad	TC		DNR																			DR	2/3
Mandya	TC		DR												DR							DR	4/4
Coimbatore	TC																	TC				DR	3/3
Vellayani	TC																					DR	2/2
Dharwad			DR																			DR	2/2
Total(DR&TC)/ Alloted	16/ 17	4/4	5/7	3/5	2/2	4/4	3/3	*	2/2	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	5	55/61

Abbreviations: DR = Data reported, DNR = Data not reported, TC = Trial continued and data to be reported after completion of the sequence, TNC = Trial not conducted

Will be started in summer, 2014, Success index (%) for TC/DR = 55/61 100 = 90%

APPENDIX-V: FORAGE CROP PROTECTION TRIAL AT A GLANCE (KHARIF-2013)

Locations /Trial	PPT-1	PPT-2	PPT-10	PPT-14	PPT-15	Total	Success index (%)
Bhubaneswar	A DR	A DR	A DR	A DR	A DR	5/5	100(%)
Hisar	-	A DR	-	-	-	1/1	100(%)
Hyderabad	A DR	A DR	-	-	-	2/2	100(%)
Jhansi	A DR	A DR	-	A DR	A DR	4/4	(100%)
Ludhiana	A DR	A DR	-	A DR	A DR	4/4	100(%)
Palampur	A DR	A DR	-	A DR	A DR	4/4	100(%)
Rahuri	A DR	A DR	-	-	-	2/2	100(%)

Abbreviations: A = Trial allotted; DR = Trial conducted and data reported;

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