Journal of AgriSearch, 11 (3): 165-169
An Open Access International Peer Reviewed Quarterly
ISSN : 2348-8808 (Print), 2348-8867 (Online)
https://doi.org/10.21921/jas.v11i03.15201

Performance of Different Nutri-Cereals in Non-Traditional Rainfed Agroecosystem of Eastern India

RAKESH KUMAR[1], J S MISHRA[2], ANUP DAS[3], ANIL KUMAR SINGH[4], SUPRIYA[5]*, SANJEEV KUMAR[6], AMITESH KUMAR SINGH[7] AND B P BHATT[8]

ABSTRACT

A long-term field experiment was initiated during *kharif* season of 2020 and 2021 at the ICAR Research Complex for Eastern Region, Patna, Bihar, India (25°30'N, 85°15'E, 52 m above mean sea levels) with an objective of designing the most productive, profitable, and sustainable climate-resilient cropping system for eastern India. Soil of experimental site was loamy in texture (50.4, 35 and 14.6% sand, silt and clay) with pH of 7.5, EC of 0.12 dS m^{-1}, soil organic carbon content of 6.0 g kg^{-1}, $KMnO_4$ oxidizable N of 64.6 mg kg^{-1}, Olsen P-23.9 mg kg^{-1}, NH_4OAc exchangeable K-78.3 mg kg^{-1} and DTPA-extractable Zn-0.66 mg kg^{-1} (0-15 cm soil). During 1st/ 2nd year of study, 07 nutri-cereals including [(jowar (CSV 15) and bajra (Proagro 9001)] and 5-minor nutri-cereals [(ragi (RAU 8), barnyard millet (VC 207), foxtail millet (Rajendra Kauni), proso-millet (TNAU 202) and kodo-millet (JK 41)] grown under 3-different planting window i.e., starting with onset of monsoon (05 July) and later at 10-days intervals (15 and 25 July). Our results revealed that 2nd planting window system (15 July) was performed better as compared to first and second planting system (5 and 25 July) in terms of crop yields. Among the nutri-cereals, jowar (3.43 t ha^{-1}) and bajra (2.89 t ha^{-1}) as major and barn yard millets (2.06 t ha^{-1}), ragi (1.93 t ha^{-1}) and kodo-millet (2.05 t ha^{-1}) as minor nutri-cereals found more productive when planted on 2nd planting window (15th July). Thus, from the present study, it may be concluded that nutri-cereals planted up to 15th July performed better in terms of crop productivity for the sustainable millets production system under non-traditional rainfed agroecosystem of eastern India.

Keywords: Climate resilient system, Crop Productivity, Panting windows, Nutri-cereals

ARTICLE INFO

Received on	:	12/07/2024
Accepted on	:	21/08/2024
Published online	:	30/09/2024

INTRODUCTION

In changing scenario of the globalization, agriculture in India must face new challenges to compete at global level in agricultural commodities (Kumar *et al.*, 2019). Indian agriculture is now facing the second-generation problems i.e. lowering the water table, nutrient imbalance, soil degradation, and salinity, resurgence of pest and environmental pollution (Kumar *et al.*, 2021a, b). Despite fact that, area in millets cultivation has been drastically reduced over years in India and particularly in eastern India (Kumar *et al.*, 2023a, b). It is one among major producers of millets in the world. This is due to productivity gains in millets which showed increase despite area shrinkage. With increase in population, per capita availability of food grains including cereal has decreased over year (Kumar *et al.*, 2022a, b). Whereas in stress tolerance conditions, millets provide nutritious food compared to other cereals with high fibre content, minerals, and slow digestibility. Millets can constantly help to meet our needs of their animal feed/fodder and will continue to be grown by dryland and resource poor farmers in the foreseeable future.

Millets are one of the cheapest sources of energy, higher digestive fibre, protein, vitamin, and mineral. In terms of nutrient intake, sorghum account for 35% of the total intake of calories, protein, iron, and Zn in dominant production/ consumption areas (Kumar *et al.*, 2017). Production of cereal demands more water and fertilizers compared to millets. Millets are hardy crops, can grow in less favourable conditions and have potential to bridge gap between demand and supply to ensure the nutritional security (Mishra *et al.*, 2017a, b). While, population pressure continues, acreage is decreasing. Despite a wider climatic adaptability, cultivation of diverse nutri-cereals/ millet species is gradually decreasing

[1] Senior Scientist, Div. of Crop Research, ICAR Research Complex for Eastern Region, Patna, Bihar, India,
[2] Director, ICAR Directorate of Weed Research, Maharajpur, Jabalpur, Madhya Pradesh, India,
[3] Director, ICAR Research Complex for Eastern Region, Patna, Bihar, India,
[4] Director Research, Bihar Agricultural University, Sabour,Bhagalpur, Bihar, India,
[5] Ph.D. Research Scholar, National Dairy Research Institute, Karnal, Haryana, India;
[6] Head, Division of Crop Research, ICAR-Research Complex for Eastern Region, Patna, Bihar, India,
[7] Scientist (Agronomy), Krishi Vigyan Kendra, ANDUAT, Ayodhya,Varanasi, Uttar Pradesh, India,
[8] Principal Scientist, NRM Division, KAB-II, New Delhi, India
*Corresponding Author E-mail: supriya.ndri5@gmail.com

in recent past (Mishra *et al*., 2018). Lack of institutional support for millets in contrast to rice and wheat continue to shrink millet growing. Despite this, several communities in dry/rainfed region having known food quality of millets over generations continue to include range of millet in traditional cropping patterns and recognize millet as an essential part of diets (Pandit *et al*., 2020; Supriya *et al*., 2023). Unlike in other parts of world, almost all millets are grown in rainy season while a few likes, sorghum and pearl millet are grown during winter in South and Central India, used for human consumption, livestock feed and raw materials for industries (Pan *et al*., 2024). Thus, millets are key for sustenance of human and livestock population in an era of the perceptible climatic changes. Introduction of nutri-cereals/ millets cultivation in dry/rainfed farming of country will help to support the farmers' livelihood in coming years (Prakash *et al*., 2017). For this, knowledge on standardization of improved production technologies has a vital role to create the awareness among end users and for its wide adoption. Thus, keeping in view of the above facts, present study was to undertake during two consecutive *Kharif* season of 2020 and 2021 at the ICAR Research Complex for Eastern Region Patna, Bihar, India.

MATERIALS AND METHODS

A long-term field experiment was initiated during *Kharif* 2020 at the ICAR Research Complex for Easten Region, Patna, Bihar, India (25°30'N, 85°15'E, 52 m above mean sea levels) with an objective of designing the most productive, profitable, and sustainable climate-resilient cropping production system for eastern India. The experimental area falls under the eastern Indo-Gangetic Plain (IGP) of India and is characterised by sub-tropical humid climate. Mean rainfall received was 727 mm during cropping period. Soil the of experimental site was loamy in texture (50.4, 35 and 14.6% sand, silt and clay) with pH of 7.5, EC of 0.12 dS m^{-1}, soil organic carbon content of 6.0 g kg^{-1}, $KMnO_4$ oxidizable N of 64.6 mg kg^{-1}, Olsen P 23.9 mg kg^{-1}, NH_4OAc exchangeable K-78.3 mg kg^{-1} and DTPA-extractable Zn-0.66 mg kg^{-1} (0-15 cm soil, Table 1).

Table 1: Initial physico-chemical properties of soil of nutri-cereals experimentation

Mechanical composition			Texture
Particulars	0-15 cm	0-30 cm	Loam
Sand (%)	50.40		
Silt (%)	35.04		
Clay (%)	14.56		
Ph	7.43		
OC (%)	0.60	0.45	
Mineralizable N (kg/ha)	146	134	
Available P (kg/ha)	54.09	35.05	
Available K (kg/ha)	177	218	
DTPA-Zn (mg/kg)	0.66	0.46	
DTPA-Fe (mg/kg)	32.95	22.90	
DTPA-Cu (mg/kg)	2.88	2.21	

During 1st/2nd year of the study, 07 nutri-cereals including 2-major [(jowar (CSV 15) and bajra (Proagro 9001)] and 5-minor nutri-cereals [(ragi (RAU 8), barnyard millet (VC 207), foxtail millet (Rajendra Kauni), proso-millet (TNAU 202) and kodo-millet (JK 41)] grown under 3-different planting window i.e., starting with onset of the monsoon (05 July) and later at 10-days intervals (15 July & 25 July 2021). Net plot size of experimental plot was 5.0 m×4.0 m. Sorghum and pearl millet planted manually at a spacing of 45 cm ×15 cm, while all minor millets were planted at a spacing of 25 cm×5 cm (Table 2).

Table 2: Crops, varieties, seed rate and fertilizers of different nutri-cereals used in experiment

Crops	Varieties	Seeding rate (kg ha-1)	Spacing (cm)	Fertiliza-tion (kg NPK-ha-1)
Sorghum/ Jowar	CSV-15	15	45×15	60-40-30
Pearl millet/ Bajra	Proagro-9001	05	45×15	80-40-40
Foxtail millet/ Kauni	Rajendra Kauni	10	25×10	60-40-25
Barnyard millet/ Sawa	VC 207	10	25×10	60-40-25
Proso-millet (Cheena)	TNAU 202	10	25×10	60-40-25
Finger millet/ Ragi	RAU 8	10	25×10	60-40-25
Kodo-millet (Kodo)	JK 41	10	25×10	60-40-25

To manage initial weed flushes, atrazine @ 0.50 kg/ha was applied as pre-emergence using 500 litres water/ha with help of knap-sack sprayer, fitted with flat-fan nozzle. Hand-hoeing was also done at 25 DAS and intra-row weeds removed by hand-weeding simultaneously. Crop was grown on fully on monsoonal rains and no-supplemental irrigation was given to crops during their cropping periods. Recommended dose of phosphorus and potassium was applied in respective crops as standard dose as basal through di-ammonium phosphate (DAP) and muriate of potash (MOP), respectively. Nitrogen was applied as per need of respective crops through urea after subtracting N amount supplied through DAP. The dose of nitrogen was applied in two equal splits, 50% as basal and remaining at 35 days after sowing (DAS). Standard agronomic management practices were followed as per crop requirement and mentioned in Table 3.

The crop was harvested separately for estimation of grain and straw/stover yield of each crop. After harvesting and threshing, the crop yield was recorded and then it was adjusted at 12% moisture content. Rice equivalent yield (REY) was computed to compare the performance of millets-based rotations by converting grain yield into equivalent yield of rice on market price of the component crops. All recorded data were analysed with help of analysis of variance (ANOVA)

Table 3: Crop phenology of different nutri-cereals under different planting windows system (Mean data of 2-years)

Nutri-cereals	Days to 50% flowering (no.)			Days to crop maturity		
	1st Planting window	2nd Planting window	3rd Planting window	1st Planting window	2nd Planting window	3rd Planting window
Sorghum/Jowar	87	70	70	115	109	108
Pearl millet/Bajra	66	53	57	104	92	105
Foxtail millet	53	45	44	81	78	74
Barnyard millet	55	49	45	87	78	73
Proso-millet	53	44	46	87	79	74
Finger millet	82	77	76	106	99	104
Kodo-millet	65	59	56	100	92	100

technique using Indian NARS Statistical Computing Portal. Least significant difference test (LSD) was used for comparison of the treatment means at 5% level of significance (P=0.05).

RESULTS AND DISCUSSION

Results from Table 4 revealed that different nutri-cereals differed significantly among themselves to attain 50% flowering and physiological maturity under different planting windows system. Among major nutri-cereals i.e., sorghum and pearl millet, recorded the minimum days (70 & 53, respectively) while planted on 15th July to attain 50% flowering while among the minor nutri-cereals, foxtail millet, barnyard millet, finger millet and kodo millet (44, 45, 76 and 56, respectively) on 3rd planting window (25th July) and proso millet (44) on 2nd planting window system to attain 50% flowering. For attaining the physiological maturity, sorghum (108), foxtail millet (74), barnyard millet (73) and proso millet (74) observed minimum days on 3rd planting window (25th July) compared to pearl millet, finger millet and kodo millet on 2nd planting window (15th July). This might be due to inherent variations in their genetic behavior of nutri-millets that has led to these differences in specific phenological attributes (Mishra *et al.*, 2017; Prakash *et al.*, 2017; Kumar *et al.*, 2023b).

Table 4: Crop yields and rice equivalent yields (REY) of different nutri-cereals under different planting windows system (Mean data of 2-years)

Nutri-cereals	1st Planting window (05 July)		2nd Planting window (15 July)		3rd Planting window (25 July)	
	Crop yields (t ha^{-1})	REY (t ha^{-1})	Crop yield (t ha^{-1})	REY (t ha^{-1})	Crop yield (t ha^{-1})	REY (t ha^{-1})
Sorghum/Jowar	2.75^{a}	4.12^{a}	3.43^{a}	5.14^{a}	2.91^{a}	4.37^{a}
Pearlmillet/Bajra	2.21^{b}	2.72^{de}	2.89^{b}	3.55^{de}	2.29^{b}	2.82^{de}
Foxtail millet/Kauni	1.39^{ef}	2.52^{ef}	1.74^{f}	3.16^{f}	1.52^{ef}	2.76^{ef}
Barnyard millet/Sawa	1.67^{cd}	3.14^{c}	2.07^{c}	3.87^{b}	1.72^{d}	3.21^{bc}
Proso-millet (Cheena)	0.66^{g}	1.23^{g}	0.86^{g}	1.62^{g}	0.59^{g}	1.11^{g}
Finger millet/Ragi	1.50^{de}	2.80^{d}	1.93^{de}	3.61^{cd}	1.59^{e}	2.98^{d}
Kodo-millet (Kodo)	1.75^{c}	3.28^{b}	2.05^{cd}	3.83^{bc}	1.82^{c}	3.40^{b}
LSD (*P*=0.05)	0.12	0.21	0.15	0.26	0.13	0.22

Crop yields and rice equivalent yields (REY) of different nutri-cereals in diverse planting windows showed significant variations, with specific trends based on planting time. Among all the nutri-cereals, sorghum/jowar consistently outperformed other nutri-cereals among all planting windows. It recorded significantly highest yield in 2nd planting window (15th July) with 3.43 t ha^{-1} showing 19.8 and 15.2% higher crop yields compared to 1st and 3rd planting window system, respectively and the highest REY of 5.14 t ha^{-1} showing 19.8 and 15% higher in comparison to 1st & 3rd planting window, respectively. In 1st planting window (5th July), it outyielded 2.75 t ha^{-1}, with a corresponding REY of 4.12 t ha^{-1}, while 3rd planting window (25th July) produced a yield of 2.91 t ha^{-1} and an of 4.37 t REY ha^{-1}. However, pearl millet/Bajra also showed high yields, with its peak yield of 2.89 t ha^{-1} on 2nd planting window showing 23.5% and 20.8% higher than 1st and 3rd planting window, respectively and an REY of 3.55 t ha^{-1}, 23.4% and 20.6% higher than 1st and 3rd planting window, respectively. In 1st and 3rd planting window system, significant yields had 2.21 t ha^{-1} (2.72 t REY ha^{-1}) and 2.29 t ha^{-1} (2.82 t REY ha^{-1}), respectively, indicating slightly better performance when planted on 15th July. While comparing among minor nutri-cereals, foxtail millet/kauni had lower yields than jowar and bajra, with the highest yield of 1.74 t ha⁻¹ was recorded under 2nd planting window having 20.1% and 12.6% higher than 1st and 3rd planting window, respectively leading to an REY of 3.16 t ha⁻¹, 20.3% and 12.7% higher than 1st and 3rd planting window, respectively. In 1st and 3rd windows, significant yields were 1.39 t ha⁻¹ (2.52 t REY ha⁻¹) and 1.52 t ha⁻¹ (2.76 t REY ha⁻¹), respectively, showing a slightly improved performance in mid-July planting window. Barnyard millet/Sawa showed considerable variation across planting windows, achieving significantly highest crop yield of 2.07 t ha⁻¹ in 2nd planting window with 19.3% and 16.9% higher than 1st and 3rd planting window, respectively and 3.87 t REY ha⁻¹, 18.9% and 17.1% higher than 1st and 3rd planting window system, respectively. 1st and 3rd windows recorded a significant yield of 1.67 t ha⁻¹ (3.14 t REY ha⁻¹) and 1.72 t ha⁻¹ (3.21 t REY ha⁻¹), respectively, indicating most favorable conditions in mid-July. However, during the study year, proso millet (Cheena) was the lowest-yielding crop across all planting windows. It produced significantly highest yield of 0.86 t ha⁻¹ in 2nd planting window with 23.3 and 31.4% higher than 1st and 3rd planting window, respectively with 1.62 t REY ha⁻¹, 24.1 and 31.5% higher than 1st and 3rd planting window, respectively. The 1st and 3rd windows had yields of 0.66 t ha⁻¹ (1.23 t REY ha⁻¹) and 0.59 t ha⁻¹ (1.11 t REY ha⁻¹), respectively. Finger millet/Ragi showed moderate yields, with significantly highest yield of 1.93 t ha⁻¹ was recorded in 2nd planting window showing 22.3 and 17.6% higher than 1st and 3rd planting window, respectively and an 3.61 t REY ha⁻¹, 22.4 and 17.5% higher than 1st and 3rd planting window, respectively. In 1st and 3rd windows, yields were 1.5 t ha⁻¹ (2.8 t REY ha⁻¹) and 1.59 t ha⁻¹ (2.98 t REY ha⁻¹), showing better performance when planted in mid-July.

Kodo millet showed relatively stable yields across windows. It was recorded significantly highest yield of 2.05 t ha⁻¹ in 2nd planting window, 14.6 and 11.2% higher than 1st and 3rd planting window, respectively with 3.83 t REY ha⁻¹, 14.4 & 11.2% higher than 1st & 3rd planting time, respectively. In 1st and 3rd window, yields were 1.75 t ha⁻¹ (3.28 t REY ha⁻¹) and 1.82 t ha⁻¹ (3.40 t REY ha⁻¹), indicating favorable growing conditions across planting periods. Results indicate that timing of planting plays a critical role in determining crop yields and REY of nutri-cereals. Among all the nutri-cereals, 2nd planting window system (15th July) generally resulted in highest crop yields and REY, suggesting that mid-July planting offers most favorable conditions for growth. The performance of sorghum/jowar across all planting windows was notably superior compared to other cereals, thus making it resilient and high-yielding option for cultivation. The findings were in line with the results of researchers in their field investigation (Kumar *et al.*, 2022b; Kumar *et al.*, 2023b). Variability in the crop yield among crops like Pearl millet, Barnyard millet, and Kodo millet suggests that these crops also benefit from mid-July planting window system, though their overall yield potential was lower than that of sorghum. Foxtail millet and finger millet, while performing moderately well in 2nd planting window, indicating their relatively lower adaptability to varying planting conditions. Proso-millet consistently exhibited tlowest yields and REY across all planting window system, highlighting its sensitivity to planting time and lower productivity as compared to other nutri-cereals. This finding suggests that Proso- millet may require more specific growing condition or improved agronomic practices to enhance its performance. Similar relationship between sowing dates and crop responses have been previously reported by Kumar *et al.* (2023b). These studies demonstrated that delayed planting shortens time to heading or flowering, leading to reduced resource capture. This reduction in canopy exposes late-planted crops to prolonged dry-spells or severe drought during reproductive stage, negatively impacting grain setting and filling.

CONCLUSION

From present study, it may be confirmed that:

Nutri-cereals crop planted up to mid-July had performed better in terms of crop yield possibly due to favorable weather conditions, including the adequate moisture and temperature, which are crucial for crop establishment and growth for sustainable millets/climate resilient system for non-traditional rainfed agroecosystem of eastern India.

- These findings provide a valuable insight for the farmers and policy makers aiming to enhance productivity of the nutri-cereals by adjusting the planting schedule based on crop type/local environmental conditions.
- Additionally, significant differences across planting windows suggest that further research may be needed to explore the influence of other factors, such as soil health, nutrient management, and pest control, on the yields of these cereals.

ACKNOWLEDGEMENT

Authors sincerely acknowledged Director, ICAR Research Complex for Eastern Region Patna, Bihar for providing all technical and financial assistance of the Institute approved Project on "Standardization of agro-techniques in nutri-cereals for enhancing the productivity in eastern India (Institute Project Code: IXX15535)

REFERENCES

Kumar M, Kumar R, Rangnamei KL, Das A, Meena KL and Rajkhowa DJ. 2019.Crop diversification for enhancing productivity for food and nutritional security under eastern Himalayas. *Indian Journal of Agricultural Sciences* **89**(7):1157–1161.

Kumar R, Krishna B, Kumar B and Mishra JS. 2021. Millets panacea for future multiple securities. *Indian farming* **71**(03):9–12.

Kumar R, Krishna B and Kumar S. 2023a. Alternate cropping systems for food and nutritional security in eastern India. *Indian Farming* **73**(08):16–19.

Kumar R, Kumar U, Singh R, Kumar A, Singh DK, Mondal S, Sundaram PK, Kumar A, Monobrullah Md, Raman RK and Upadhyaya A.2022a. Efficiency of different cropping systems for sustaining productivity in middle Indo-Gangetic Plains. *Indian Journal of Agricultural Sciences* **92**(8):996–1000. https://doi.org/10.56093/ijas.v92i8.117619

Kumar R, Makarana G, Mishra JS and Bhatt BP.2022b.Response of sorghum (*Sorghum bicolor*) cultivars to nitrogen in non-traditional areas of Bihar. *Indian Journal of Agricultural Sciences* **92**(9):1076–1079. https://doi.org/10.56093/ijas.v92i8.

109875

Kumar R, Makarana G, Prakash V, Hans H, Mishra JS and Upadhyaya P K.2023b.Utilization of thermal indices for production of nutri-cereals in non-traditional areas of Bihar. *Indian Journal of Agronomy* **68**(3):287–292.

Kumar R, Mishra JS, Dwivedi SK, Kumar R, Rao KK, Samal SK, Choubey AK and Bhatt BP. 2017. Nutrient uptake and content in sorghum cultivars (*Sorghum bicolor* L) under summer environment. *Plant Physiology Reports* **22**(3):309–315. DOI:10.1007/s 40502 -017-0306

Kumar R, Mishra JS, Mondal S, Meena RS, Sundaram PK, Bhatt BP, Pan RS, Lal R, Saurabh K, Chandra N, Samal SK, Hans H and Raman RK.2021. Designing an ecofriendly and carbon-cum-energy efficient production system for the diverse agroecosystem of South Asia. *Energy* **214**:118860. https://doi.org/10.1016/j.energy.2020.118860

Kumar R, Prakash V, Hans H, Singh AK and Mishra JS. 2022c.Sorghum cultivation under non–traditional areas of eastern Indo–Gangetic plains. *Indian Farming* **72**(2):24–26.

Mishra JS, Kumar R and Rao SS.2017a.Performance of sweet sorghum (*Sorghum bicolor*) cultivars as a source of green fodder under varying levels of nitrogen in semi-arid tropical India. *Sugar Tech* **19**:532–538. https://doi.org/10.1007/s12355-016-0506-2

Mishra JS, Kumar R, Ravikumar S, Kumar R, Prakash V, Rao KK and Bhatt BP.2017b. Production potential of improved grain sorghum cultivars (*Sorghum bicolor*) under staggered plantings in non–traditional areas of eastern India. *Indian J. Agronomy* **62**(1):74–80.

Mishra JS, Kumar R, Upadhyay PK and Hans H.2018.Weed management in millets. *Indian Farming* **68(**11):77–79.

Mishra JS, Rao AN, Singh VP and Kumar R. 2020.Weed management in major field crops. Indian Society of Agronomy.

Pan RS, Mali SS, Kumar R, Naik SK, Shinde R and Upadhyay PK.2024.An evaluation of energy and carbon budgets in diverse cropping systems for sustainable diversification of rainfed uplands in India's Eastern Hill and Plateau Region. *Frontiers in Sustainable Food Systems*: In Revision.

Pandit SK, Prasad S, Singh MK, Singh YK, Niranjan IK and Kumar R. 2020.Effect of fertility level, plant density and age of seedling on transplanted pearl millet (*Pennisetum glaucum*). *International Journal of Current Micro-biology and Applied Sciences* **9**(6): 1124–1131.

Prakash V, Mishra JS, Kumar R, Kumar R, Kumar S, Dwivedi SK, Rao KK and Bhatt BP.2017. Thermal utilization and heat use efficiency of sorghum cultivars in middle Indo–Gangetic Plains. *Journal of Agrometeorology* **19**(1): 29–33.

Supriya, Singh M, Kumar R, Verma P and Kumar B.2023. Success of millet cultivation in eastern Himalayas. *Indian Farming* **73**(07):33–35.

Citation:

Kumar R, Mishra J S, Das A, Singh A K, Supriya, Kumar S, Singh Kumar A and Bhatt BP.2024. Performance of different nutri-cereals in non-traditional rainfed agroecosystem of Eastern India. *Journal of AgriSearch* **11**(3): 165-169