ANNALS OF PLANT SCIENCES
ISSN: 2287-688X
OPEN ACCESS
www.annalsofplantsciences.com

ORIGINAL RESEARCH ARTICLE

# Performance of promising aromatic rice entries and rapeseed-mustard varieties grown as '*paira*' crop under red and laterite zone of West Bengal, India.

**K. Jana[1]*, S. K. Das[1], G. K. Mallick[2], B. Biswas[1], A. M. Puste[4], M. Mondal[3]**
[1]Directorate of Research, Bidhan Chandra Krishi Viswavidyalaya, Kalyani- 741235, Nadia, West Bengal, India.
[2]Rice Research Station, Bankura-722 101, West Bengal, India.
[3]Rice Research Station, Chinsurah, Hooghly, West Bengal, India.
[4]Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur- 741252, Nadia, West Bengal, India.

**Received:** November 21, 2015; **Accepted:** December 28, 2015.

**Abstract:** A field experiment on 'Performance of promising aromatic rice entries and rapeseed-mustard varieties grown as '*paira*' crop under red and laterite zone of West Bengal, India' was conducted at Rice Research Station, Bankura during 2013-14 under red and laterite areas of West Bengal. The experimental result revealed that IET 21455 recorded the highest grain yield of 4.12 t ha$^{-1}$ among promising aromatic rice entries. Highest seed yield of 765.7 kg ha$^{-1}$ was recorded from NML 25 among rapeseed-mustard varieties, which were grown as '*paira*' crop after rice in the same field.

**Key Words:** Promising aromatic rice entries; rapeseed-mustard; paira and Bankura.

## Introduction

Rice (*Oryza sativa* L.) is an important staple food and grown across the world. It is the second most widely consumed cereal in the World next to wheat (Kumari *et al.*, 2014). Now a day's cultivation of traditional rice varieties is becoming more uneconomical due to mainly raising cost of labour on one hand and low price for the coarse varieties on the other hand. Aromatic rice is the major types of rice. Aromatic rice contributes a small, but it is an important sub group of rice. Aromatic rice is rated best in quality and fetches much higher price in International market. These are now becoming more popular in Middle East, Europe and the United states (Das and Baqui, 2000). It is the rice with natural chemical compounds, which give it distinctive scent. It has aroma and taste due to presence of a volatile chemical compound which is 2-Acetyl-1-Pyrroline. It is generally medium to long-grained rice. Numerous varietals of rice are aromatic, ranging from the famous Basmati to much lesser known '*Randhunipagal*'. Aromatic rice is preferred and earned a very good price both in International and the local market. It has good demand for preparation of *Biryani* and *Pulao*. Aromatic rice possesses different important characters like, a) pleasant and exquisite aroma, b) soft texture, c) sweet taste and 5) delicate curvature and extra elongation with breadth wise swelling on cooking. Traditional aromatic rice types are photo-period sensitive and these are mainly grown in rainfed lowland situation during '*aman*' season *i.e. kharif* (Das and Baqui, 2000). Traditional tall aromatic rice has the tendency to lodge under application of heavy doses of nitrogenous fertilizer and these cultivars are poor yielder.

India is the fourth largest oilseed economy in the world. Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseeds production and ranks second after groundnut sharing 27.8% in the India's oilseed economy. Effective management of natural resources, integrated approach to plant-water, nutrient and pest management of rapeseed-mustard cultivation to newer areas under different cropping systems will play a key role in further increasing and stabilizing the productivity and production of rapeseed-mustard. Rapeseed-mustard is the third important oilseed crop in the world after soybean and palm oil. Among the seven edible oilseed cultivated in India, rapeseed-mustard (*Brassica* spp.) contributes 28.6% in the total production of oilseeds. Yellow sarson (*B. rapa* var. *trilocularis*) is cultivated in Assam, Bihar, Orissa, and West Bengal as rabi crop. Improved varieties of mustard stabilize oil and seed yield through insulation of cultivars against major biotic and abiotic stresses enhance oil (low erucic acid) and seed meal (low glucosinolate) quality. It is also grown as a catch crop. It can be grown as '*paira*' or '*utera*' crop (Sekhawat *et al.*, 2012).

Information on aromatic rice – rapeseed-mustard as '*paira*' or '*utera*' crop in red and lateritic areas of West Bengal are scanty. This type of cropping sequence is most useful for the resource poor farmers of our country. Therefore, an attempt was made for achieving production of aromatic rice and rapeseed-mustard as '*paira*' crop in red and laterite areas of West Bengal, India under changed climate. *Paira* or *utera* is a method of cropping in which the sowing of next crop is done in the standing crop without any tillage operation. Mustard sowing under *paira*/*utera* in the rice field has shown its edge over line sowing and broadcasting in eastern parts of Indian (Sekhawat *et al.*, 2012). The objective of the present study was to study the performance of some promising aromatic rice entries and rapeseed-mustard group mainly different yellow sarson (*Brassica rapa* var. Yellow sarson) varieties grown as '*paira*' crop after rice in the same field. Keeping the above facts in mind this present study was conducted.

## Materials and Methods

The research-based information on aromatic rice - rapeseed-mustard group mainly yellow sarson as '*paira*' crop is very meager. So, on the basis of this fact, a field experiment on 'Performance of elite aromatic breeding lines and yellow

***Corresponding Author:**
**Dr. Kalyan Jana,**
Assistant Professor in Agronomy,
BCKV, Kalyani, West Bengal, India.

sarson as paira crop under red and laterite zone of West Bengal, India' was conducted during 2013-14 at Rice Research Station, Bankura, West Bengal on sandy loam soil.

**Promising aromatic rice entries:** This experiment was laid out in randomised block design (RBD) with three replications. Eight elite aromatic breeding lines (promising entries) were $V_1$- Pusa Basmati, $V_2$- IET 21850, $V_3$- IET 21267, $V_4$- IET 21556, $V_5$- IET 21842, $V_6$- CN 1646-5, $V_7$- IET 21455 and $V_8$- *Danaguri* (local) and these were randomly allotted in blocks. Rice seed treated with carbendazim @ 2g per kg seed and seeding was done in the nursery bed for raising seedling. Regarding the fertilizer management, the recommended dose was N, $P_2O_5$, $K_2O$ @ 80, 40, 40 kg ha$^{-1}$. 25% of recommended dose of nitrogen, full dose of phosphorus, 75% of potash and $ZnSO_4$ @ 25 kg ha$^{-1}$ were applied as basal. Remaining dose of N in two splits was applied. 50% N at active tillering stage and 25% N along with 25% Potash at Panicle initiation stage were applied. Regarding weed management Butachlor @ 1.5 kg *a.i.*/ha at 3 days after transplanting (DAT) and 2,4-D Na salt (80 WP) @ 0.06 kg *a.i.*/ha at 20 DAT were applied. One hands weeding was done at 50 DAT. The 5 m$^2$ area in the middle of each plot was harvested for recording grain yield. The required cultural practices and plant protection measures were followed as per recommended package.

**Rapeseed-mustard group mainly yellow sarson as '*paira*' crop:** This experiment was laid out in randomised block design (RBD) with three replications. Eight yellow sarson (*Brassica rapa* var. Yellow sarson) varieties were $V_1$: B-9, $V_2$: Jhumka, $V_3$: NML 25, $V_4$: YSK 09-2, $V_5$: YSH 401, $V_6$: PRO 0306, $V_7$: NDYS 141-3 and $V_8$: Ragini and were randomly allotted in the same blocks in standing aromatic rice crop at flowering stage. Yellow sarson varieties were grown as 'paira' crop in the same aromatic rice field with utilization of residual moisture and nutrient. The plot size was 4 X 3 m. Regarding fertilizer management, top dressing with 20 kg N ha$^{-1}$ at 25 DAS and foliar application of borax @ 0.2% (2 g per lit. of water) at 45 DAS were done.

**Characteristics of experimental soil:** The characteristics of red and laterite soils are poor in organic matter content, available phosphate and in bases with a very low water holding capacity. The texture of experimental soil was sandy loam with slightly acidic in nature (pH: 5.5), 0.13 ds m$^{-1}$ EC, medium in organic carbon 0.62 %, available $P_2O_5$ 85 kg ha$^{-1}$ and available $K_2O$ 240 kg ha$^{-1}$. The characteristics of red and laterite soils are poor in calcium, organic matter content, available phosphate and in bases.

## Results and Discussion

**Performance of promising aromatic rice entries:** Performance of elite aromatic breeding lines was evaluated in red and lateritic zone of West Bengal during *kharif* 2013. From the Table 1, it was noticed that the maximum number of matured panicles m$^{-2}$ (398) and highest panicle weight (1.97 g) was recorded from IET 21455 and it was statistically at par with CN 1646-5. The lowest number of matured panicles m$^{-2}$ (232) as well as panicle weight (1.37 g) was recorded from '*Danaguri*' (local) and it was statistically at par with Pusa Basmati 1. The experimental results revealed that IET 21455 recorded the highest grain yield of 4.12 t ha$^{-1}$. It was statically at par with that of CN 1646-5, which recoded the grain yield of 3.85 t ha$^{-1}$. The lowest grain yield (2.42 t ha$^{-1}$) was recorded from Pusa Basmati 1 (Check) among the elite aromatic breeding lines as well as from '*Danaguri*' (local) (1.92 t ha$^{-1}$). Islam *et al.* (1996) reported that the yield of aromatic rice (particularly traditional type) was low (1.5-2.0 t ha$^{-1}$), but its high price and low cost of cultivation generated more profit margins as compared to other cultivated rice. IET 21850 and IET 21842 also performed better under red and lateritic zone of West Bengal (Table 1).

**Performance of rapeseed-mustard group mainly yellow sarson varieties as '*paira*' crop:** The experimental results revealed that the plant height of rapeseed-mustard group ('*paira*' crop) at harvest stage was not statistically significant (Table 2). Regarding the number of silique plant$^{-1}$, it was statistically significant. The highest number of siliqua per plant (42.5) was recorded from NML 25 and it was statistically at par with that of number of silique per plant (39.7), which was obtained with NDYS 141-3. These were also statistically at par with that of number of silique per plant (36.8) and it was recorded from B-9. The lowest number of silique per plant (16.7) was obtained with YSK 09-2 and it was statistically at par with that of number of silique per plant (18.5), which was recorded from YSH 401 (Table 2). It was revealed from the experimental results that the highest seed yield of 765.7 kg ha$^{-1}$ was recorded from NML 25 (rank-1) and it was statistically at par with that of seed yield of 750.3 kg ha$^{-1}$, which was recorded from NDYS 141-3 (rank-2) in '*paira*' cropping under red and lateritic zone of West Bengal during *rabi* season. Performance of B-9 (rank-3) was also good in '*paira*' cropping sequence, which was noticed from Table 2. This might be due to the highest number of silique per plant was obtained with NML 25. It is one of the important yield attributing character and which was reflected in the highest seed yield of NML 25 under '*paira*' cropping sequence. This result corroborated with the findings of Shekhawat *et al*., 2012 significantly higher yield (887 kg ha$^{-1}$) of mustard was recorded when sown as '*paira*' or '*utera*' crop over line and broadcast sown crop at Bhubaneswar. The lowest seed yield of 470.5 kg ha$^{-1}$ was obtained from YSK 09-2 (rank-8). It was statistically at par with that of 495.1 kg ha$^{-1}$, which was recorded from YSH 401 (rank-7) (Table 2). Rapeseed-mustard varieties in this experiment were grown mainly by utilized the stored soil moisture and residual fertility in the soil after harvesting of paddy crop (promising aromatic rice entries) of *kharif* season.

## Conclusion

From the present study, it can be concluded that among the elite aromatic breeding lines, IET 21455 recorded the highest grain yield of 4.12 t ha$^{-1}$. IET 21850 and IET 21842 also performed better under red and lateritic zone of West Bengal among promising aromatic rice entries. In case of rapeseed-mustard varieties, the highest seed yield of 765.7 kg ha$^{-1}$ was recorded from NML 25 in '*paira*' cropping system. This '*utera*' or '*paira*' system of cropping of rapeseed-mustard varieties is most important approach for saving water, fertilizer and labour etc. View extrapolated from the results of this experiment that rapeseed-mustard group mainly yellow sarson varieties crop can be successfully

grown in '*paira*' system of cropping. NML 25 (rank-1), NDYS 141-3 (rank-2) and B-9 (rank-3) perform well as '*paira*' crop after rice under western parts of West Bengal. Aromatic rice - '*Paira*' cropping of rapeseed-mustard varieties, mainly yellow sarson is much beneficial for the resource poor farmers of West Bengal, particularly in red and laterite zone of the state.

## Acknowledgements

The authors would like to thanks Dr. P. K. Maity, Chief Agronomist, FCRS, Burdwan; Mr. M. Dhara, Agronomist; Mr. S. R. Patra, Additional Director of Agriculture (Research); Dr. P. Bhattacharyay, Director of Agriculture, Writers' Building, Kolkata -1 and Prof. B. K. Mandal, retired Professor and former Head and Prof. K. Sengupta, Head, Department of Agronomy, Prof. K. Brahmachari, Prof. C. K. Kundu, Prof. Pintoo Bandyopadhyay, Department of Agronomy, Bidhan Chandra Krishi Viswavidyalay, Mohanpur, Nadia, West Bengal, India for their valuable guidance and encouragement during the period of this research programme.

**Table 1:** Grain yield and ancillary characters of promising aromatic rice entries during *kharif* season

| Treatments | Elite aromatic breeding lines | No. of matured Panicles $m^{-2}$ | Panicle wt. (g) | Grain yield (t $ha^{-1}$) |
|---|---|---|---|---|
| $V_1$ | Pusa Basmati 1 | 256 | 1.62 | 2.42 |
| $V_2$ | IET 21850 | 378 | 1.75 | 3.72 |
| $V_3$ | IET 21267 | 286 | 1.68 | 3.05 |
| $V_4$ | IET 21556 | 267 | 1.64 | 2.83 |
| $V_5$ | IET 21842 | 357 | 1.71 | 3.58 |
| $V_6$ | CN 1646-5 | 389 | 1.87 | 3.85 |
| $V_7$ | IET 21455 | 398 | 1.97 | 4.12 |
| $V_8$ | *Danaguri* (Local) | 232 | 1.37 | 1.92 |
| **S. Em (±)** | | 8.31 | 0.09 | 0.32 |
| **CD (0.05)** | | 25.1 | 0.28 | 0.93 |

**Table 2:** Performance of different rapeseed-mustard varieties in '*paira*' cropping sequence after promising aromatic rice during *rabi* season of 2013-14.

| Treatments | Varieties | Plant height (cm) at harvest | Number of silique/ plant | Test weight (g) | Seed yield (kg $ha^{-1}$) | Rank |
|---|---|---|---|---|---|---|
| **$V_1$** | B-9 | 64.8 | 36.8 | 2.8 | 680.4 | 3 |
| **$V_2$** | Jhumka | 74.1 | 20.3 | 2.7 | 560.6 | 6 |
| **$V_3$** | NML 25 | 76.2 | 42.5 | 2.9 | **765.7** | **1** |
| **$V_4$** | YSK 09-2 | 77.3 | 16.7 | 2.6 | **470.5** | **8** |
| **$V_5$** | YSH 401 | 78.5 | 18.5 | 2.6 | 495.1 | 7 |
| **$V_6$** | PRO 0306 | 67.3 | 25.2 | 2.8 | 591.8 | 5 |
| **$V_7$** | NDYS 141-3 | 69.7 | 39.7 | 2.5 | **750.3** | **2** |
| **$V_8$** | Ragini | 72.5 | 31.2 | 2.7 | 668.2 | 4 |
| S.Em (±) | | 15.8 | 6.2 | 0.35 | 35.1 | |
| CD (P=0.05) | | NS | 18.6 | NS | 105.6 | |

## References

1. Anonymous. *Annual Report: 2013-14*, Rice Research Station, Bankura, West Bengal, India: 2014. 31-32 and 46-47.

2. Kumari, P., Mishra, G. C., Pant, A. K., Shukla, G. and Kujur, S. N. Comparison of forecasting ability of different statistical models for productivity of rice (*Oryza sativa* L.) in India. *The Ecoscan*. 8 (3 & 4): 2014. 193-198.

3. Sekhat, K., Rathore, S. S., Premi, O. P., Kandpal, B. K. and Chauhan, J. S. Review article on 'Advances in Agronomic management of Indian mustard [*Brassica juncea* (L.) (Zernj.cosson)]: An overview'. Article ID 408284. *International Journal of Agronomy*. Volume 2012 (2012), 14 pages.

4. Das, T. and Baqui, M. A. Aromatic rices of Bangladesh. pp. 2000. 184-187.

5. In Singh, R. K; Singh, U. S. and Khush, G. S. (eds.), *Aromatic Rices*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi and Calcutta, India.

6. Islam, M.R., Mustafi, B. A. A. and Hossain, M. Socio-economic aspect of fine quality rice cultivation in Bangladesh, In: *Rice Research prioritization*, 1996. BRRI/IRRI.

**Cite this article as:**

K. Jana, S. K. Das, G. K. Mallick, B. Biswas, A. M. Puste and M. Mondal. Performance of promising aromatic rice entries and rapeseed-mustard varieties grown as '*paira*' crop under red and laterite zone of West Bengal, India. *Annals of Plant Sciences* 4.12 (2015): 1236-1238.

**Source of support:** Reseach Wing, Department of Agriculture, Govt. of West Bengal
**Conflict of interest:** No