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ROLE OF PARTICIPATORY VARIETAL SELECTION IN RICE IMPROVEMENT IN LOW LAND ECOSYSTEM

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ABSTRACT

This study used participatory varietal selection (PVS) which provide opportunities for male and female farmers' to express their preference for rice varieties at the early stages of the breeding process.. With an objective to know farmers' likes and dislikes for rice, Participatory Varietal Selection was conducted consisting of twenty three genotypes including rice varieties introgressed with the SUB1 gene and other lines along with check at two locations viz., ARI, Mithapur, Patna and Sakraurha, Jehanabad. At ARI, Patna 55 farmers participated in the preference analysis and selected Rajendra Sweta as best followed by RAU 748-18-6 while at Sakraurha, Jehanabad, 52 farmers participated and voted RAU 731-2-201 as best followed by RAU 729-12-44 for having features like semi-tall plant, good tillers, long panicle, small and compact grains, expecting good market price etc. in the preference analysis. IR-64 and IR-64 Sub-1 were least preferred varieties at both the locations for having features like poor plant population, lodging, poor number of tillers, unfertile grains, poor grain color, un-synchronized panicle emergence, susceptible to diseases. The correlation between male and females, farmers and breeders for selecting these genotypes were highly significant.

Key words : *Participatory Varietal Selection, sensory evaluation, submergence tolerant rice, Sub-1 gene, mother trial.*

Rice, the most important cereal crop in the world is cultivated under diverse agro-ecosystems in India as well as in Bihar. Among various ecosystem, lowland ecosystem is responsible for cultivation of long duration rice varieties having higher yield and contributing maximum to the yield basket. But, often these varieties are encountered by submergence or flash flooding resulting in lower yield. As submergence is considered to be the third important damaging abiotic stress in rainfed lowland rice in the world (Widawski and O'Toole, 1990). Flash flood and submergence adversely affect more than 22 m ha of rainfed lowland rice area of the world (Khush, 1984).

Flash flooding refers to a situation where rice crop gets submerged due to sudden increase in flood water for varying periods, normally not exceeding 10-12 days (Senadhira, 1992). Flash flooding occurs mainly during vegetative stage and the period of flooding depends on the intensity and duration of rainfall. Tolerance to submergence in rice is governed by genetical, physiological and environmental factors. Thus there is a need to develop rice varieties which can recover from floods/submergence.. To facilitate and accelerate adoption of these submergence tolerant varieties, it is necessary to identify men and women farmers' criteria and preferences in selecting rice varieties in their specific rice environments (Borjas, 1997). The present investigation was attempted to study the best preferred lowland lines by the farmers following Participatory Varietal Selection.

MATERIALS AND METHODS

Site Selection : Two Mother trials were laid out during Kharif, 2009-10 at Agricultural Research Institute (ARI), Patna, Bihar and Sakraurha village, Jehanabad, Bihar consisting of 23 rice entries including IR-64 Sub-1, BPT 5204 Sub-1 and Swarna (MTU 7029) Sub-1 as checks. At ARI Patna the trial was Researchers-managed trial having a plot size of 4X4 m^2 with a spacing of 30X10 cm^2 between and within the rows. 25 days old seedlings were transplanted. Recommended package and practices were followed for a healthy crop growth.

At Sakraurha, the trial was a farmers –managed trial wherein farmers evaluated the same set of line on their own plots using their level of inputs and managements. Here 30 days old seedlings were transplanted. To monitor the performance of the new lines, a structural questionnaire was used to interview

Table-1 : Preference analysis of rice genotypes of Mother trial at ARI, Patna.

Entry		Male (n=34)		Female (n=21)		Scientist (n=4)		Total (n=55)		Preference Score
Code	Name	+VE	-VE	+VE	-VE	+VE	-VE	+VE	-VE	
V1	RAU 731-2-201	12	0	0	0	0	0	12	0	0.05
V2	RAU 730-20-178	4	0	2	0	0	0	6	0	0.03
V3	RAU 732-106-3	2	1	2	0	0	0	4	1	0.01
V4	RAU 751-176-9	3	1	0	0	0	0	3	1	0.01
V5	RAU 670	0	7	0	4	0	2	0	11	-0.05
V6	RAU 759-5-41	0	1	0	4	2	0	0	5	-0.02
V7	RAU 748-18-6	13	0	6	0	3	0	19	0	0.09
V8	RAU 637-99-55	1	0	2	0	0	0	3	0	0.01
V9	RAU 639-200-55	3	0	2	0	0	0	5	0	0.02
V10	RAU 735-17-2	0	4	0	4	0	0	0	8	-0.04
V11	RAU 678-82-4	0	0	4	0	0	0	4	0	0.02
V12	RAU 729-12-44	1	0	2	0	2	0	3	0	0.01
V13	RAU 724	0	0	4	0	0	2	4	0	0.02
V14	RAU 708	0	2	0	14	0	2	0	16	-0.07
V15	RAU 649	0	0	4	0	1	0	4	0	0.02
V16	Swarna Sub-1	0	0	0	0	0	0	0	0	0.00
V17	Swarna	6	0	2	0	0	1	8	0	0.04
V18	IR-64 sub-1	0	32	0	12	0	1	0	44	-0.20
V19	IR-64	0	19	0	4	0	0	0	23	-0.10
V20	BPT 5204 Sub-1	0	0	0	0	0	0	0	0	0.00
V21	BPT 5204	0	1	2	0	0	0	2	1	0.00
V22	Rajendra Mahsuri-1(LC)	6	0	4	0	0	0	10	0	0.05
V23	Rajendra Sweta (LC)	17	0	6	0	0	0	23	0	0.10

Table-2 : Preference analysis of rice genotypes of Mother trial at Sakraurha, Jehanabad.

Entry		Male (n=34)		Female (n=21)		Scientist (n=4)		Total (n=55)		Preference Score
Code	Name	+VE	-VE	+VE	-VE	+VE	-VE	+VE	-VE	
V1	RAU 731-2-201	17	1	12	1	2	0	29	2	0.13
V2	RAU 730-20-178	9	1	3	0	0	0	12	1	0.05
V3	RAU 732-106-3	1	1	0	0	0	0	1	1	0.00
V4	RAU 751-176-9	1	3	0	3	0	0	1	6	-0.02
V5	RAU 670	0	3	3	5	0	2	3	8	-0.02
V6	RAU 759-5-41	2	1	3	0	0	0	5	1	0.02
V7	RAU 748-18-6	0	0	0	0	0	0	0	0	0.00
V8	RAU 637-99-55	1	1	5	0	0	0	6	1	0.02
V9	RAU 639-200-55	1	0	0	0	0	0	1	0	0.00
V10	RAU 735-17-2	0	0	0	0	0	0	0	0	0.00
V11	RAU 678-82-4	0	1	2	0	0	0	2	1	0.00
V12	RAU 729-12-44	10	1	14	2	6	0	24	3	0.10
V13	RAU 724	3	1	2	2	0	6	5	3	0.01
V14	RAU 708	0	2	0	0	0	5	0	2	-0.01
V15	RAU 649	0	2	0	0	0	0	0	2	-0.01
V16	Swarna Sub-1	0	2	2	3	0	0	2	5	-0.01
V17	Swarna	0	2	3	4	0	0	3	6	-0.01
V18	IR-64 sub-1	0	7	2	5	0	4	2	12	-0.05
V19	IR-64	1	9	3	13	0	4	4	22	-0.09
V20	BPT 5204 Sub-1	0	3	0	2	0	0	0	5	-0.02
V21	BPT 5204	0	4	0	3	0	0	0	7	-0.03
V22	Rajendra Mahsuri-1(LC)	0	1	4	8	0	0	4	9	-0.02
V23	Rajendra Sweta (LC)	0	0	0	7	0	0	0	7	-0.03

Table-3 : Correlation in preferences of Male, Female Farmers and Breeders of PVS Mother Trial 2009 at both the locations.

Site	Station	Stress	Entries (n)	Male vs. Female	Farmer vs. Breeder	Farmers vs Yield
RAU-Pusa	ARI, Patna	Submergence	23	0.70***	0.38*	0.31
RAU-Pusa	Sakraurha, Jehanabad	Submergence	23	0.82***	0.61***	0.42**

*Significant at 10%, **Significant at 5%, ***Significant at 1%

farmers of the village on the soil and flood condition, yield and other opinion along with socio-economic status of the farmers.

Preference Analysis : In order to select two best and two least preferred lines among the entries, the PA was conducted on 22nd November, 2009 and 23rd November, 2009 at ARI, Patna and Sahraurha, Jehanabad respectively with the involvement of males, females and researchers at ripening stage of the crop. Farmers' preferences were gathered through voting process and by assigning codes *eg.* V1 to V23 for each line/variety. This was done to remove the bias from selecting lines/varieties. These farmers were allowed to "vote" for their preferred varieties during a field day by depositing paper ballots in a bag or envelope in front of the plot. Ballots with 'Y' (most preferred) and ballots with 'X' (least preferred) were prepared with three colors: blue, pink, and yellow. Blue ballots were given to male farmer-participants; pink ballots to female participants and yellow for breeders/researchers. Two ballots with 'Y' letters and two ballots with 'X' letters were given to 2 rice varieties that they like best (designed positive votes) and 2 rice varieties that they most dislike (designed as negative votes). These were the raw data collected to know total positive and negative votes for a rice variety.

Preference scores : Preference analysis (PA) generates two kinds of data: (a) quantitative preference score for each variety, expressed as the number of votes it received divided by the total number of votes cast, and (b) qualitative opinions of male and female farmers on why they like and dislike new lines/varieties. Farmers' opinions were discussed immediately after tallying the votes during the field visits.

The preference score (PS) for each variety is calculated as follows :

PS = (Number of positive votes-negative votes)/Total number of positive and negative votes

The preference scores for males and females were presented. However, identification of the "most" and "least" preferred varieties or selection was based on the combined male and female farmers' preference scores.

Pearson Correlation (PC) was used to investigate the relationships between two variables (*x* and *y*). This technique was used to test whether preference scores between male and female farmers as well as between researchers and farmers were significant correlation or not. If PC's coefficient (r) is positive, there is a direct correlation on preference score between male and female as well as between researchers and farmers.

Pearson Correlation was also used to investigate the relationships between rice yield and farmers' preference score. If correlation coefficient (r) is positive, there is a direct correlation on farmers' preference score between and yield. If r is negative, there is an inverse correlation on preference score between farmers and yield.

The level of correlation was classified based on r as following:

0.00 – no correlation

0.01-0.20 – very weak correlation

0.21-0.40 – weak correlation

0.41-0.60 – moderate correlation

0.61-0.80 – strong correlation

0.81-0.99 – very strong correlation

1.00 – perfect correlation

RESULTS AND DISCUSSION

The result of preference analysis of ARI, Patna and Sakraurha, Jehanabad has been shown in Table-1 and Table-2 respectively. At ARI, Patna 55 farmers participated in the preference analysis and selected Rajendra Sweta as best followed by RAU 748-18-6 while at Sakraurha, Jehanabad, 52 farmers participated and voted RAU 731-2-201 as best followed by RAU 729-12-44 for having features like semi-tall plant, good tillers, long panicle, small and compact grains, expecting good market price etc. in the preference analysis. There was a difference between selections of best lines at both the location which might be due to location difference. IR-64 and IR-64 Sub-1 were least preferred varieties at both the locations for having features like poor plant population, lodging, poor

number of tillers, unfertile grains, poor grain color, un-synchronized panicle emergence, susceptible to diseases.

Correlation in preferences of Male, Female Farmers and Breeders of PVS Mother Trial 2009 at both the locations has been collectively shown in Table-3. The correlation between male and female farmers' preference scores were strong and significant at ARI, Patna. This means that with r= 0.70 (at 1% level of significance), male and female farmers strongly agree on their preferences for the best performing varieties tested in the researcher-managed trials. Similarly, at Sakraurha, Jehanabad there was significant and very strong correlation between the male and female farmers' preference scores. This means that with r= 0.82 (at 1% level of significance), male and female farmers very strongly agree on their preferences for the best performing varieties tested in the farmer's-managed trials. However, the correlation analysis between farmers (both male and female combined) and researchers showed weak correlation with r= 0.38 at 5% level of significance at ARI, Patna resulting in differences of their opinion choice of a variety. At Sakraurha, Jehanabaad when farmers' preferences are compared to the researchers' preferences, the correlation analysis shows strong correlation with r= 0.61 at 1% level of significance. At ARI, Patna a weak correlation between the preference scores of farmers and yield (r = 0.31) was recorded though their relationship is not significant whereas it was moderate and significant (r = 0.42) at 5% level of significance at Sakraurha, Jehanabaad. Similar findings were reported by previous workers. The results show that there is strong agreement between the farmers' preferences, given their own reasons and set of criteria for selection, and the researchers' own criteria in selecting good performing varieties. The better performing selected lines can be put into Baby trials and can further be assessed with the participating farmers and more for its wider adaptability and release. At the same time the likes and dislikes of farmers can be put into considerations for further breeding programmes.

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