



Evaluation of Short Duration Varieties of Paddy through Frontline Demonstrations in Punjab

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Abstract: Groundwater depletion in Punjab is at alarming stage due to technological (long duration varieties) and policy (free electricity) factors. Short duration varieties can give a relief in this situation by using less water for paddy production. So, since 2016-17, frontline demonstrations of rice varieties PR 121 and PR 126 were conducted by Punjab Agricultural University under Farmer FIRST Programme of the Indian Council of Agricultural Research (ICAR) for popularization of these varieties. A study was conducted to evaluate the performance of these varietal demonstrations. Findings revealed that cost of cultivation of PR 121 and PR 126 was lower than the check variety (Pusa 44) and giving similar yield. In terms of economic returns, these short duration varieties are giving similar or higher net returns than Pusa 44 resulting higher benefit to cost ratio.

Keywords: Water, Short duration, Yield, Returns, PR 121, PR 126

Development of irrigation facilities is one of the major factors behind success of the Green Revolution in Punjab which eradicated the hunger and ensured food security in India (Singh and Kohli 1997). During the Green Revolution era, focus was shifted to the pumping groundwater to ensure continuous irrigation supply (Balkrishna et al 2022) and since then, most of irrigation demand in Punjab is fulfilled by installing tube wells to extract groundwater (Perveen et al 2012). The number of tube wells increased enormously in last five decades in Punjab from 1.92 lakh in 1970-71 (Bajwa et al 2017) to 14.76 lakh in 2020-21 (GoP 2021). Further minimum support prices (MSP) provided by the government made the farmers habitual to growing only paddy and wheat crops which resulted in the depletion of ground water table in Punjab. Punjab is producing about 139.91 lakh metric tonnes of paddy from the area of 31.49 lakh hectares (GoP 2021). Study conducted by Kaur (2021) revealed that farmers are applying 2033 litres of water to produce one kg of paddy, so high irrigation water requirement coupled with large area under paddy is eroding the groundwater resources of Punjab. To meet the water demand in Punjab, 35.78 BCM water is being withdrawal every year having availability of only 21.58 BCM, leading to the 166 per cent extraction rate as percentage of total percolation and at such withdrawal rate, ground water resources of Punjab are likely to be used in 20-25 years (Anonymous 2018).

With such scarcity of ground water resources in Punjab, unrecommended long duration varieties are increasing the threat to water resources. So Punjab Agricultural University

(PAU) has developed short duration varieties of paddy, which can sustain the water resources as well as give sufficient produce as compared to long duration varieties (Singh et al 2022). Further to transfer various sustainable technologies to farmers fields' and popularize among them, Farmer FIRST Programme (FFP) was started by ICAR, and under this programme two villages in Sangrur District of Punjab were adopted by the PAU, Ludhiana in the year 2016-17. To convince the farmers through the grass root level methodology, frontline demonstrations (FLDs) of PR 121 and PR 126 were conducted in the adopted villages. So, this study was conducted to evaluate the performance of these short duration varieties as compared to other long duration varieties such as Pusa 44 to generate the research feedback and policy interventions.

MATERIAL AND METHODS

Farmer FIRST Programme was implemented in Punjab in 2016-17, and two villages from district Sangrur were selected under this programme. To sensitize the farmers regarding water saving and popularization of recommended short duration varieties, 300 FLDs having an area of 0.4 ha for each demonstration of PAU recommended short duration varieties (PR 121 & PR 126) were conducted on farmers' fields in each year from 2017-18 to 2021-22 thus totaling 1500 FLDs in last five years (Table 1).

The necessary steps for selection of site, selection of farmers, layout of demonstrations etc. were followed as suggested by Choudhary (1999) and Venkatasubramanian

et al (2009). Farmers were provided with the trainings as per requirement and guidance through the field visits from time to time. To evaluate the performance of FLDs, adjacent local checks of Pusa 44 were selected to record the data. Data regarding yield, cost of cultivation, returns were collected for the FLDs and check plots. B:C ratio was calculated using the net returns and cost of cultivation.

RESULTS AND DISCUSSION

Varietal characteristics: Farmers were growing water guzzling long duration unrecommended varieties of paddy in the village before the commencement of FFP, so PR 121 and PR 126 which take much less time and give comparable yield to the Pusa 44 were introduced in the adopted village. Both PR 121 and PR 126 are resistant to bacterial blight and matures in 110 and 93 Days after Transplanting (DAT), respectively.

Performance of PR 121 FLDs: The study evaluated the performance of PR 121 on the basis of yield as compared to Pusa 44 (Table 3) and findings revealed that farmers obtained the comparable yield of PR 121 to the Pusa 44. Although a slightly higher yield of Pusa 44 is not advantageous while taking into consideration the maturity time of varieties, which is 25-30 days more for Pusa 44. Further it can be observed from the data that FLDs yield for each year is higher the average potential yield, which revealed the good performance of FLDs. Singh et al (2022) also revealed the similar finding regarding the yield comparison of PR 121 and Pusa 44.

Recommended short duration varieties are taking much less time and resources than Pusa 44, so it is not advisable to compare the both varieties only on the basis of yield, but ultimate net returns can be the suitable indicator. So data in Table 4 highlights the performance of PR 121 in economic terms. Finding showed that cost of cultivation for the FLDs is lower than check plot ranging from Rs 2766 to Rs 4650 per ha in each year. Gross returns from the PR 121 FLDs on is somewhat lower (Rs 2653 to Rs 8780 per ha) due to slight

Table 1. Frontline demonstrations of short duration varieties conducted under Farmers FIRST Programme

Year	Paddy variety (No. of FLDs)	
	PR 121	PR 126
2017-18	100	200
2018-19	100	200
2019-20	100	200
2020-21	150	150
2021-22	-	300
Total	450	1050
Grand total	1500	

difference in yield except the in 2019-20, when yield of PR 121 surpassed the yield of Pusa 44 and fetched Rs. 2464 per ha higher gross returns. The net returns from the PR 121 FLDs were similar or more than Pusa 44 in each year due to the lower cost of cultivation leading to the higher benefit cost ratio of PR 121.

Table 2. Characteristics of short duration varieties selected for FLDs

Character	PR 121	PR 126
Plant height	98 cm	102 cm
Maturity	110 DAT	93 DAT
Resistance	Bacterial blight	Bacterial blight
Average yield	76.25 q/ha	75.00 q/ha

Source: PAU (2022); DAT= Dates of transplanting

Table 3. Yield performance of PR 121 FLDs

Year	Yield (q/ha)	
	FLDs (PR 121)	Local check (Pusa 44)
2017-18	80.69	82.52
2018-19	78.69	80.52
2019-20	79.90	78.50
2020-21	77.80	82.50

Table 4. Economic analysis of PR 121 FLDs

Particulars	FLDs (PR 121)	Local check (Pusa 44)	Change
2017-18			
Cost of cultivation (Rs/ha)	28199	31139	-2940
Gross returns (Rs/ha)	117001	119654	-2653
Net returns (Rs/ha)	88801	88515	+286
B.C ratio	3.15	2.84	+0.31
2018-19			
Cost of cultivation (Rs/ha)	34779	38039	-3260
Gross returns (Rs/ha)	137707	140910	-3203
Net returns (Rs/ha)	102928	102871	+57
B.C ratio	2.96	2.70	+0.26
2019-20			
Cost of cultivation (Rs/ha)	36628	39394	-2766
Gross returns (Rs/ha)	140624	138160	+2464
Net returns (Rs/ha)	103996	98766	+5230
B.C ratio	2.84	2.51	+0.33
2020-21			
Cost of cultivation (Rs/ha)	40780	45430	-4650
Gross returns (Rs/ha)	145330	154110	-8780
Net returns (Rs/ha)	104550	108680	-4130
B.C ratio	2.56	2.39	+0.17

Performance of PR 126 FLDs: Finding from the FLDs (Table 5) reveal that farmers obtained the similar yield in PR 126 FLDs as of Pusa 44. PR 126 variety of paddy gained much popularity among the farmers due to its short maturity period and comparable yield to the other varieties and due to its enormous popularity, only PR 126 variety was selected for FLDs in 2021-22. In 2017-18, 2018-19, 2020-21 & 2021-22, PR 126 gave slightly lower but comparable yield to the check

Table 5. Yield performance of PR 126 FLDs

Year	Yield (q/ha)	
	FLDs (PR 126)	Local check (Pusa 44)
2017-18	80.60	82.03
2018-19	78.60	80.30
2019-20	79.60	78.30
2020-21	78.50	82.20
2021-22	79.50	81.20

Table 6. Economic analysis of PR 126 FLDs

Particulars	FLDs (PR 126)	Local check (Pusa 44)	Change
2017-18			
Cost of cultivation (Rs/ha)	28943	32486	-3543
Gross returns (Rs/ha)	116866	118940	-2074
Net returns (Rs/ha)	87923	86454	+1469
B.C ratio	3.04	2.66	0.38
2018-19			
Cost of cultivation (Rs/ha)	35905	40003	-4098
Gross returns (Rs/ha)	137550	140052	-2502
Net returns (Rs/ha)	101645	100049	+1596
B.C ratio	2.83	2.50	+0.33
2019-20			
Cost of cultivation (Rs/ha)	36920	40772	-3852
Gross returns (Rs/ha)	140096	137333	+2763
Net returns (Rs/ha)	103176	96561	+6615
B.C ratio	2.79	2.36	+0.43
2020-21			
Cost of cultivation (Rs/ha)	40380	46324	-5944
Gross returns (Rs/ha)	146638	153549	-6911
Net returns (Rs/ha)	106258	107225	-967
B.C ratio	3.63	3.31	+0.32
2021-22			
Cost of cultivation (Rs/ha)	38200	44625	-6425
Gross returns (Rs/ha)	154230	157528	-3298
Net returns (Rs/ha)	116030	112903	+3127
B.C ratio	3.04	2.53	+0.51

variety (Pusa 44), but in 2019-20, PR 126 outperformed Pusa 44 with slight increase in yield. Findings regarding the yield were in line with Singh (2022), who also found that yield of PR 126 was slightly lower than Pusa 44.

Further economic data (Table 6) revealed that farmers spent about Rs 3500 to Rs 6500 less on the cultivation of PR 126 than Pusa 44 in each year. Gross returns from the PR 126 were also somewhat lesser than Pusa 44 due to yield differences except in 2019-20. The maximum gross returns difference was in 2019-20 of Rs 6911 per ha. But FLDs on PR 126 proved to obtain similar net returns as Pusa 44 due to the lower cost of production and similar yield. The maximum increase in net returns was in the year 2019-20 of Rs 6615 per ha due higher yield and lower cost of cultivation of PR 126. This ultimately resulted to the higher benefit cost ratio of PR 126.

CONCLUSION

Short duration varieties can be a measure for respite in ground water depletion in Punjab through water saving and generating sustainable produce. So under FFP, the varieties PR 121 and PR 126 were evaluated through frontline demonstrations in adopted villages in Sangrur (Punjab) under Farmer FIRST Programme. Findings proved the comparable yield and similar or higher economic returns from these varieties as compared to the other non-recommended varieties. It can be concluded that farmers can generate good income using less resources in terms of water and time from these varieties.

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