

## Effect of Technological Interventions on Rice Yield at Farmers' Field

Atar Singh<sup>1</sup>, A. K. Singh<sup>2</sup> and Lakhan Singh<sup>3</sup>

1 & 3. Principal Scientist (Agronomy & Agril. Ext.), 2. Zonal Project Director,  
Zonal Project Directorate, Zone-IV (ICAR), G.T. Road, Rawatpur, Kanpur-208 002

Corresponding author e-mail: atarsingh\_icar@rediffmail.com

### ABSTRACT

*Rice is one of the most important food crop grown in Uttar Pradesh. It is grown in Indo-Gangetic plains in rice – wheat cropping system. The productivity of rice in the state continues to be quite low on account of several biotic and abiotic stresses besides, unavailability of quality seed of improved varieties and inadequate crop management. The analysis of results indicated that hybrid varieties registered yield advantage of 4.62 q/ha as compared to varieties grown by the farmers. Similarly appropriate cropping systems showed the yield advantage between 4.35 to 12.15 q/ha as compared to traditional practice by farmers. The trials on nutrient management registered gain up to 0.98 to 17.61 q/ha over the farmers' practice of using old variety and traditional crop management practices. Resource conservation gave advantage of 8.67 q/ha over farmers' practice of not using resource conservation techniques, weed management realized yield gain of 6.50 q/ha over farmers practices. It has been found that yield advantages can be attained in rice by the use of improved varieties, integrated nutrient management, resource conservation and recommended insect and disease management regime.*

**Key words:** On –farm trials; Crop geometry; Resource conservation; Nutrient management; Weed control;

Rice is one of the most important food crops in Uttar Pradesh. It is grown in Indo-Gangetic plains in rice – wheat cropping system (RWCS). The total area under RWCS in the country Uttar Pradesh accounts for 45 per cent (Chand and Haque, 1998). The acreage under this system is about 13.50 million ha and contributes 12.63% of total food grain in India with cumulative share of production is 40.68%, of which rice is grown in an area of 6.03 million ha with production of 13.10 million tonnes and the productivity levels of 21.71 q/ha (Anonymous 2009-10). The yield levels are still very low and hence, efforts are being made through KVK's by conducting problem based interventions at farmers' fields. The ground realities are that farmers are still adopting undesired practices because of various reasons for e.g. use of old varieties, imbalance use of fertilizers, very low use of resource conservation technologies, herbicides, insecticides and pesticides etc. In this context, trials were conducted with the purpose to assess the recommended technologies with farmer's participation in the existing farming situations to maximize the production potential in varied situations

### METHODOLOGY

Major mandate of the KVK is assessment, refinement and demonstration of technology/products. To achieve the main mandate, the KVKs have been organizing On-Farm Trials to identify the location specificity of agricultural technologies under various farming systems. The research recommendations derived in well managed situations, when taken to the farmers' conditions, tend to give different outputs. In pursuance, On Farm Trials (OFTs) were conducted with 16 different technologies related to rice at 144 farmers' fields in districts viz Allahabad, Fatehpur, Sultanpur, Faizabad, Ballia, Basti, Mau, Varanasi, Saharanpur, Shahajanpur and Unnao, representing various agro-ecological situations of Uttar Pradesh. The objective of these trials was to assess the recommended technologies with farmer's participation in the existing farming situations and standardize the production potential in varied situations. In all the trials, farmers' practices were compared with the recommended practices for the zone. Farmers' participation was ensured right from problem identification stage to

implementation and evaluation of the interventions. Evaluation parameters included yield advantage (Singh *et al.* 2006).

## RESULTS AND DISCUSSION

**Response of rice varieties :** The hybrid varieties (Table 1) tested in district Sultanpur have given higher yields viz Pro- agro-6444 (56.42 q/ha) followed by GK-5006 (49.30 q/ha) under medium duration & GK -6516 (48.75 q/ha) under long duration as compared to short duration varieties. The variety Pro-agro-6444 resulted additional yields of 8.30q/ha over inbred variety grown by the farmers. Scented hybrid rice variety PRH-10 also demonstrated good yield (41.80 q/ha).

**Cropping system :** In district Saharanpur (Table 2), Pant Dhan 4667 sown in the proper plant population 40-50 plants/m<sup>2</sup> have given yield of (59.42 q/ha) followed by plant population 30-40 plants/m<sup>2</sup> (51.45 q/ha) as compared to farmers' practice. The additional yield advantages ranged from 4.35-12.15 q/ha over farmers' practice.

**Nutrient management - response of organic source & inorganic fertilizers :** In district Fatehpur, trials were conducted with four replications. Farmers were using NPK @ 150:100:0 kg/ha and were getting yield performance of 31.20 q/ha. Treatment of recommended practice i.e. NPK @ 120:60:40 kg/ha + blue green algae @ 2 kg/ha resulted the yield of 38.30 q/ha as compared

**Table 1. Yield performance of rice varieties**

KVK	Problem identified	Intervention	Treatment	Production (q/ha)
Sultanpur	Use of old varieties	Evaluation of different hybrid varieties	T <sub>1</sub> : GK-6516 (Long duration) T <sub>2</sub> : PA-6444 (Medium duration) T <sub>3</sub> : GK-5006 (Medium duration) T <sub>4</sub> : GK-6129 (Medium duration) T <sub>5</sub> : H-6606 (Medium duration) T <sub>6</sub> : PRH-10 (Short duration)	48.75 56.42 49.30 47.43 42.74 41.80

**Table 2. Yield performance of rice under different crop geometry**

KVK	Problem identified	Intervention	Treatment	Production (q/ha)
Saharanpur	Improper plant population	Application of different plant geometry	T <sub>1</sub> - Farmers Practice (25 plants m <sup>2</sup> ) T <sub>2</sub> - 30-40 Plant /m <sup>2</sup> T <sub>3</sub> - 40-50 Plant / m <sup>2</sup>	47.10 51.45 59.25

to farmer's practice. The yield advantage was 7.10 q/ha. In district Faizabad, trial on PBT-5204 variety with four replications was conducted. The farmers were using N: P @ 200:20 kg/ha and getting yield of 46.15 q/ha. The treatment was taken with N: P: K @ 120: 60:40 kg/ha resulted yield of 49.34 q/ha. Recommended doses of fertilizers + Azatobactor @ 2.5 kg/ha + PSB @ 3.0 kg/ha exhibited yield of 47.13 q/ha. With the use of N: P: K @ 120: 60:40 kg/ha + Azatobactor @ 2.5 kg/ha + PSB @ 5.0 kg/ha. the yield gain was 50.06 q/ha.. The yield advantage ranged from 0.98 to 3.90 q/ha on farmers' practice.

The farmers of district Raebareli was conducted trial on NDR 359 variety. Farmers were not using vermicompost and were harvesting yield of 32.00 q/ha. The treatment N: P: K @ 120:60:60 kg/ha + vermicompost 2.5 tonnes/ha resulted yield gain of 40.80 q/ha. Similarly, recommended doses of fertilizers coupled with vermicompost resulted in to yield of 41.5 q/ha which is almost equal to recommended doses of fertilizers.

In district Ballia, the trial on Sarju 52 variety was

conducted with four replications. Farmers were found using only N: P @ 150:20 kg/ha + Zn So<sub>4</sub> 25 kg/ha and attaining yield of 41.30 q/ha. The treatment using NPK @ 120:60:60 kg/ha + Zn So<sub>4</sub> 25 kg/ha, the yield gain was quite higher (53.91 q/ha). The recommended doses of fertilizer i.e. NPK @ 100:60:40 kg/ha + Zn So<sub>4</sub> 25 kg/ha and rest N applied based on leaf colour chart resulted the yield of 58.91 q/ha. The yield advantage was noted as 17.61 q/ha in case of treatment T<sub>3</sub> followed by 11.80 q/ha in case of T<sub>2</sub> as compared to farmers' practice (Table 3).

In district Sultanpur, participated in conducting the trial on NDR 359 variety with four replications under paddy wheat rotation. Earlier farmers were using imbalance dose of fertilizers NPK @ 120:60: 35 kg/ha with the yield of 52.21 q/ha. The use of vermin-compost @ 1.5 t/ha + fertilizer of NPK 60:30:17 kg / ha, the grain yield of 51.94 q/ha could be recorded. When the nitrogen @ 60kg/ha +vermicompost @3 t/ha was applied, it resulted yield of 49.52 q/ha. The treatment T<sub>2</sub> and T<sub>3</sub> yielded almost equal grain yield with the

reduced doses of fertilizer as compared to farmer's practice (*Singh and Singh, 2009*).

**Resource conservation technologies:** KVK, Maharajganj laid out the trial on PBT 5204 variety with three replications. Farmers were using NP @140:50 + Zn So4 25kg /ha with the yield of 36.05 q/ha. The trials were conducted at farmers' fields with the use of zero till machine + NPK @ 120:60:60 kg/ha + pendimethaline @ 3.25 l/ha as pre emergence. Out of total nitrogen 80% was applied as basal on leaf colour chart, which resulted yield of 39.62 q/ha. In another treatment use of zero till machine + NPK @ 120:60:60 kg/ha, 80% nitrogen applied as basal and rest based on leaf colour chart + pendimethaline @ 3.25 l/ha as pre emergence with sesbania brown green manuring by application of 2,4-D @ 1kg/ha as post emergence provided the yield of 44.72 q/ha. So, the grain yield advantage was noted as 8.67 q/ha over farmer's practice.

KVK, Basti laid out the trial on PBT 5204 variety with three replications. Farmers were using NP @140:50 + ZnSo4 25kg /ha with the yield of 42.20 q/ha. The trials were conducted at farmers' fields with direct seeded rice with stale bed technique of zero till machine + NPK @ 120:60:60 kg/ha + pendimethaline @ 3.25 l/ha as pre emergence. Out of total nitrogen 80% was applied as basal on leaf colour chart, which provided the yield of 43.70 q/ha. In another treatment use of zero - till machine + NPK @ 120:60:60 kg/ha, 80% nitrogen

applied as basal and rest based on leaf colour chart (LCC) + pendimethaline @ 3.25 l/ha as pre emergence with sesbania brown green manuring by application of 2,4-D @ 1kg/ha as post emergence provided the yield of 44.50 q/ha. So, the grain yield advantage was noted as 1.50 and 2.30 q/ha over farmer's practice under treatment T2 and T3 respectively.

KVK, Mau laid out the trial on direct seeded rice with NDR 359 variety. Farmers were using NP @140:50 + Zn So4 @ 25kg /ha were attaining the yield of 28.75 q/ha. The trials were conducted at farmers' fields with direct seeded rice with stale bed technique of zero till machine + NPK @ 120:60:60 kg/ha + pendimethaline @ 3.25 l/ha as pre emergence. Out of total nitrogen 80% was applied as basal on leaf colour chart, which provided the yield of 29.20 q/ha. In another treatment use of zero till machine + NPK @ 120:60:60 kg/ha, 80% nitrogen applied as basal and rest based on leaf colour chart + pendimethaline @ 3.25 l/ha as pre emergence with sesbania brown green manuring by application of 2,4-D @ 1kg/ha as post emergence provided the yield of 30.50 q/ha. So, the grain yield advantage was noted as 0.40 and 1.75 q/ha in treatment t2 and t3 respectively over farmer's practice (Table 4).

**Effect of weed management :** The trials were laid out in district Mau against the problem of weeds (Table 5). The farmers were using variety Sarju 52 +NP @ 150:40 kg/ha, without weedicide use and the yield were

**Table 3. Effect of organic and inorganic fertilizers on rice yield**

KVK	Intervention	Treatment	Production (q/ha)
Fatehpur	Balance use of fertilizer	T <sub>1</sub> – Farmers practice NPK @ 150:100:0	31.2
		T <sub>2</sub> - NPK @ 100:60:40+BGA	35.8
		T <sub>3</sub> - NPK @ 120:60:40+BGA	38.3
Faizabad	Balance fertilizer use with bio-agents	T <sub>1</sub> - Farmers practice (NPK @ 200:20:0 kg/ha)	46.15
		T <sub>2</sub> - NPK @ 120:60:40 kg/ha	49.34
		T <sub>3</sub> - T1+Azotobactor @ 2.5+PSB @ 3.0 kg/ha	47.13
		T <sub>4</sub> - T2+ Azotobactor @ 2.5+PSB @ 5.0 kg/ha	50.06
Raebareli	Use of NPK along with vermicompost	T <sub>1</sub> - Farmers practice (No use of vermicompost)	32.00
		T <sub>2</sub> - NPK @ 120:60:60kg/ha	36.80
		T <sub>3</sub> - NPK @ 120:60:60 kg/ha+ vermicompost. @ 2.5 tonnes/ha	40.80
		T <sub>4</sub> - NPK @ 120:60:60 kg/ha+ 50 % vermicompost.	41.50
Ballia	Nitrogen management on the basis of Leaf Colour Chart	T <sub>1</sub> - Farmers practice (NPK @ 150, 20, 0 + ZnSo4 @ 15 kg /ha	41.3
		T <sub>2</sub> - NPK @ 120, 60, 60 + ZnSo4 25 kg/ha	53.91
		T <sub>3</sub> - NPK @ 100, 60, 60 + ZnSo4 25 kg/ha + rest N based on Leaf Colour Chart (LCC)	58.91
Sultanpur	Application of Vermi-compost with NPK in paddy– wheat rotation	T <sub>1</sub> - Farmers Practice (NPK @ 120:60:35 kg/ha	52.21
		T <sub>2</sub> - Vermicompost @ 3 tonnes + 60kg N /ha	49.52
		T <sub>3</sub> - Vermicompost. @ .1.5 tonnes + NPK @ 60:30:17kg/ha	51.94

obtained as 33.00 q/ha. When another treatment variety Sarju 52 +NPK @ 120:60:40 kg/ha + pendamethaline @3.33 l/ha pre- emergence was used, The yield was noted at 39.50 q/ha. In another treatment, the Butachlore

50 EC @ 4l/ha was used which resulted into yield performance of 39.80 q/ha. Hence, the weed may be controlled along with gain in yields. The yield advantage was noted as 6.80 q/ha over farmer's practice.

**Table 4. Effect of resource conservation technologies on rice yield**

KVK	Problem identified	Intervention	Treatment	Production (q/ha)
Maha-rajganj	Imbalance use of fertilizer	Direct Seeded Rice and nutrient management through Sesbania (B GM) & LCC	T <sub>1</sub> - Transplanting +Use of NPK @ 140:50:0+ Znso4 @ 25kg/ha	36.05
			T <sub>2</sub> - Direct seeded rice with stale bed technique with Zero Till + Pendimethaline @3.25l/ha + NPK @ 120:60:60 kg/ha	39.62
			80% N as basal, Rest by Leaf Colour Chart	
Basti	Imbalance use of fertilizer	Assessment of Direct Seeded Rice under Stale Bed technique and nutrient management	T <sub>3</sub> - T <sub>2</sub> + sesbania brown green manuring + application of 2,4 -D @ 1.0kg/ha	44.72
			T <sub>1</sub> - Transplanting +Use of NPK @ 140:50:0+ Znso4 @ 25kg/ha	42.2
			T <sub>2</sub> - Direct seeded rice with stale bed technique ZT machine + Pendimethaline @3.25l/ha + 80% N as basal rest N based on Leaf Colour Chart	43.7
Mau	Imbalance use of fertilizer	Assessment of Direct Seeded Rice under Stale Bed technique and nutrient management	T <sub>3</sub> - T2 + B G.M of sesbania + application of 2,4 -D @ 1.0kg/ha	44.5
			T <sub>1</sub> - Transplanting +Use of NPK @ 140:50:0+ Znso4 @ 25kg/ha	28.75
			T <sub>2</sub> - Direct seeded rice with stale bed technique (ZT) + Pendimethaline @3.25l/ha + 50% N as basal & rest LCC based.	29.20
			T <sub>3</sub> - T2+ 50%N as basal & rest Leaf Colour Chart based + sesbania (B GM)+ application of 2, 4- D @ 1.0kg/ha	30.50

**Table 5. Effect of different weedicides on rice yield**

KVK	Problem identified	Intervention	Treatment	Production (q/ha)
Mau	Low yield of rice due to Weeds	Application off herbicides	T <sub>1</sub> : Farmers practice (NPK @ 150:40:0+ No use of weedicides)	33.00
			T <sub>2</sub> : Pendimethalin 30 EC @ 3.33 l/ha + NPK @ 120:60:40kg/ha	39.50
			T <sub>3</sub> : Butachlore 50 EC@ 4 l/ha. NPK @ 120:60:40kg/ha	39.80

## CONCLUSION

It is evident from the results that, the improved varieties registered yield gains of 4.62 q/ha. Recommended doses of fertilizers i.e. N:P:K @ 120-150: 60-80: 40-60 kg/ha, Azotobactor @ 5 kg/ha + PBS @ 5 kg/ha, Zinc 25 kg/ha in deficient areas provided additional yield of 0.98 to 7.61 q/ha over farmers' practice. The resource conservation technologies

coupled with improved varieties, recommended doses of fertilizers and direct seeded rice with stale bed sowing attained yield advantage of 8.67 q/ha as compared to traditional practices. Weed management specially through herbicides application i.e. pendimethaline @3.33 l/ha and butachlore 50 EC @ 4l/ha provided additional yield of 6.80 q/ha. Organic sources as vermicompost @ 2.5 t/ha and inorganic fertilizer doses provided yield

advantage of 0.98-17.61 q/ha over the chemical fertilizers. Therefore, it has been verified that yield advantages, can be attained by the use of improved varieties, cropping systems, integrated nutrient & weed

management and resource conservation technologies in farmers' conditions.

***Paper received on*** : ***November 09, 2011***

***Accepted on*** : ***September 13, 2012***

## REFERENCES

- Anonymous (2009-10). Annual report. Project Directorate of Farming Systems Research, Modipuram, Meerut, U.P.
- Chand, Ramesh and Haque, T. (1998). Rice-wheat cropping system in Indo-Gangetic region: issues concerning sustainability. *Economic and political weekly*. **33**(26): A108-A112.
- Singh Atar and Singh AK.(2009). Farmers' Harnessing Higher paddy yield with Technology Interventions. Paper presented in 5<sup>th</sup> National Extension Education Congress during, March 5-7 held at CSAUT, Kanpur.
- Singh, A.K.; Singh, Atar; Singh, Lakhan and Prasad, R. (2006). Annual Progress Report of Zonal Coordination Unit. Published by Zonal Coordination Unit, Zone-IV (ICAR), Rawatpur, Kanpur. pp: 91-95.

• • • • •