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RESEARCH

ON FARM TRIALS: ROLE OF PRODUCTION ENHANCEMENT IN WHEAT (*TRITICUM AESTIVUM L.*) IN ARID REGION OF WESTERN RAJASTHAN

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Abstract: A farmer's participatory field experiment was conducted during two *rabi* seasons of 2020-21 and 2021-22 at farmers' fields in Lohawat,Kalimai, Siyonka baas and Bhojka villages of Jodhpur district of Rajasthan on loamy fine to coarse and medium to low in fertility status. The study aimed to analyze the performance and adoption of improved new agriculture technology is a crucialaspects under innovation diffusion process and the most important forenhancing agriculture production at a faster rate. These aspect On Farm Trials technology is one of the most powerful tools for assessment and transfer of technology.The present study was find out the production enhancement and economics through On Farm Trials technology of wheat on farmers' fields. The technology On Farm Trial recorded additional pooled yield over farmers' practices under OFTs the grain, straw and biologicalyieldsof wheat was increased 17.08, 13.63and15.10percent over farmers' practices. Adoption of improvedpackage of practices under OFTs in wheat cultivation recorded higher B:C ratio 4.66 as compared to farmers' practices 4.07 and net returns under OFTs was Rs. 101700 and farmers'practicesRs84325 recorded. Improved technology (OFTs) grain, straw and biological yields was 41.8, 54.2 and 96q/ha as compared to farmers' practices 35.7, 47.7 and 83.4 q/ha.

Keywords: Economics, Farm trial, Productivity, Wheat

INTRODUCTION

Wheat (*Triticum aestivum* L.) is a staple food of the world's and belongs to poaceae family. Rice- wheat is the world's largest agricultural production system covering around 12.3 Mha in India (Bhatt *et al.*, 2016). Its origin North Western parts of the India sub-continents. About 80 to 85 percent of wheat grains are consumed in the form of chapaties made by wheat flour. It ranks first in the World among the cereals both in area (219.5 Mha) and production (758.02 MT) USDA, report, 2017-18. In India, it is cultivated as an area of 30.70 Mha having production of 98.51 MT with average productivity of 3200 kg/ha (USDA, report, 2017-18). U.P. rank first with respect of area and production but productivity is much high in Punjab & Haryana. The wheat production among *rabi* cereals was 12.01million tonnes from an area of 3.10 million hectares with a productivity of 3869 kg/ha in Rajasthan. In the Phalodi district, the wheat crop is grown in an area of 25889 ha with an annual production of over 47749 million tons with a productivity of 1866 kg/ha. Among the major constraints limiting wheat production, cultivation on marginal and sub marginal lands of poor fertility coupled with inadequate nutrition, moisture stress, raising the crop on saline and alkaline soils with poor quality of irrigation water and heavy infestation with weeds are important. Moreover, it is grown mainly on light textured soils, low in N, P and organic matter contents with poor moisture retentive capacity. Wheat crop is infested by a large number of fast-growing weeds flora. It is infested with both grassy and broadleaf weeds. The losses caused by weeds have been estimated to be much higher than those caused by insects, pests and diseases together (Fakkar and Amin, 2012). Weeds germinate even before its germination and flourish more and more taking the advantage of its slow initial growth. Competition from weeds throughout the crop season reduces yield by 10 to 38 % depending upon time and intensity of weed infestation; Balyan and Malik, 1994). So, there is an urgent need to applied suitable weed management practices for both grassy and broadleaf weeds for exploiting the yield potential of this crop.

Conventional method of physical weed management practices in wheat is time consuming and labour intensive. However, the important benefits of providing greater aeration, improving root growth enabling greater absorption of moisture

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and nutrients from deeper soil layers. Due to increased demand of labours, sometimes the farmers fail to work out the intercultural operations, timely. To overcome this situation, exploring the possibility of a suitable broad spectrum and cost-effective herbicide deserves attention. The chemical control of weeds in general has been realised to be more cost effective and easy compared to manual weeding (Yadav and Malik, 2005).Herbicides play an important role for weed control in close spaced crops like wheat and barley where manual or mechanical weeding is difficult (Yaduraju and Mishra, 2002). Chemical weed management practices are most ideal options to overcome this problem.Carfentrazone-ethyl is a contact herbicide used to control broadleaf and sedges in cereals. It is use as foliar spray and is absorbed through plant leaves. Translocation after its absorption is limited. Carfentrazone-ethyl is approved for all cereals crops including barley, wheat, oatsand triticale. A newly contact herbicide carfentrazone of triazolinone group applied at 20-25 g/ha as post-emergence (30-40 DAS) provides excellent control of problematic broadleaf weeds such as *Convolvulus arvensis and Malva parviflora* in wheat. Major weed florawhich appeared during the OFT season along with their details have been described in table 4.1.Study of the OFT fields during both years of trials observed that weedy check plots of wheat were heavily infested by annual dicot weeds chiefly *Chenopodiummurale* and *Chenopodium album* immediately with the crop emergence. *Rumexdentatus*wasthe other weed florathatwere found to infest at later stages of crop growth.To conducting the On Farm Trials on farmers' field help to identify potential technology compared to farmers' practices and powerful tools to find out the suitable technology for a area (Singh *et al*., 2013) it help in improving the socio-economic status.

MATERIALS AND METHODS

The present study On Farm Trials were conducted on wheat in irrigated condition in Jodhpur district of Rajasthan. Wheat is an important *rabi* crop of the area but its productivity is quite low. Weeds are recognized as one of the major negative factor of crop production and has been causing heavy losses to the wheat crop and farmers using banned & Old herbicide 2,4-D for control the weeds in the wheat field at 30-35 DAS. Therefore, the present OFT was undertaken by KVK Phalodi to find out low cost and new efficient weedicide for wheat crop. The title of OFT was: "Management of narrow and broad leaf weeds in wheat".ICAR-Directorate of weed research, Jabalpur recommended an herbicide (Carfentrazone-ethyl) and has broad-spectrum activity for control of all types of weeds in wheat. In total 08 on farm trials were conducted on farmers' field in villages *viz*.,Bhojka, Kalimali, Lohawat, Phalodi and Siyoka baas of Jodhpur district of Rajasthan during 2020-21 and 2021-22. Each on farm trials was conducted on an area of 0.4 ha, adjacent-to the on farm trials plot was kept as farmer's practices. Observation on two major performance indicators *viz*. (1) Technical observations: identification of several weed flora, plant stand (per metre row length) and plant height (cm) of wheat at 40 DAS & at harvest stage, yield and yield attributes of wheat and harvest index (%)during crop season, (2) Economic indicator: likes Gross cost (Rs./ha) Gross return (Rs./ha), Net return (Rs./ha) and Benefits Cost Ratio and ICBR and (3) Farmers reaction and feedback: on assessed technology were also observed and all the observations collected from eight on farm trials (assessed and control plots) and there feasibility and economic viability were evaluated. The package of improved technologies like line sowing, nutrient management, seed treatment and whole package were used in the on farm trials. The wheat variety Raj 4079was included in on farm trials methods used for the present study with respect to on farm trials and farmers' practices. In case of local check plots, existing practices being used by farmers were followed. In general, soils of the area under study were loamy fine to coarse and medium to low in fertility status. The spacing was 22.5 cm between rows and 5-7cm between plants in the rows. Seed sowing was done in the mid to last week of November, with a seed rate of 100 kg/ha. Other management practices were applied as per the PoP for *rabi* crops by Department of Agriculture, Agro-climatic Zone Ia-Arid Western Plains Zone. Data with respect to grain yield from on farm trials plots and from farmer's fields cultivated following local practices adopted by the farmers of the area were collected and evaluated.

Treatments details:

Farmer's practices (T1): Useof 2,4-D @ 0.5 kg a.i./ha at 30 DAS

Assessed technology (T2): Carfentrazone-ethyl 20 gma.i./ha (25-30 DAS)

RESULTS AND DISCUSSION

(i) **Weed study:** The observation indicated that major weed flora which appeared during the crop season along with their details have been described in table 1. Study of the on farm trialsduring both years of trials observed that T1 plots of wheatwere infested by annual dicot weeds namely *Chenopodium murale* and *Chenopodium album* immediately with the crop emergence. *Cyperus rotundus*, *Phalaris minor* and *Cynodon dactylon* were noted to be among the most dominating monocot weed flora in the crop season.

(ii) **Plant stand & Plantheight:**As per table 2no weed management practices brought about any significant variation in plant stand of barley at 40 DAS and at harvest stage during both the years of trials.Pooled results indicated that treatmentT2 was improving this growth character of wheat at 40 DAS and harvest stages.T2(Carfentrazone-ethyl 20 gma.i./ha (25-30 DAS)observed the maximum plant height of 25 and 108.1 cm at 40 DAS and at harvest stage as compared tofarmers' practices (24.5 and 96.6 cm).It enhanced the plant height by 2.04 and 11.9 per cent at 40 DAS and at harvest stage, overfarmers' practices treatmentT1 (Use of 2,4-D @ 0.5 kg a.i./ha at 30 DAS), respectively.

(iii) **Impact of OFTs on yield attributes of wheat:** Pooled results calculated(Table 3) thattreatmentT2 (Carfentrazone-ethyl 20 gma.i./ha (25-30 DAS) recorded the maximum total & effective tillers/plant, spike length (cm) and grains/spike of 8.00, 5.97, 7.74 and 38.93 during 2020-21 and 2021-22as compared to farmers' practices (7.64, 5.37, 7.45 and 38.51).

(iv) **Impact of OFTs on yields & Harvest index:** The data (Table 4) indicated that both years of trials as well as in pooleddataobserved that treatmentT2 (Carfentrazone-ethyl 20 gma.i./ha (25-30 DAS) produced the maximum grain, straw and biological yields of wheat was 41.8, 54.2 and 96.0 q/ha over farmers' practices (35.7, 47.7 and 83.4 q/ha).It registered remarkable increase in grain, straw and biological yields of wheat to the extent of 17.08, 13.63 and 15.10 % over farmers' practices, respectively. Thetreatment T2 (Carfentrazone-ethyl 20 gma.i./ha (25-30 DAS) recorded the harvest index (43.54) as compared to farmers' practices (42.80).The technologyof On Farm Trial recorded additional yield over farmers' practices under OFTs. The results are close conformity with the research results of Sharma *et al*., 2016.

ECONOMICS

The economics parameters of On Farm Trialof wheat crop are calculated in table 5 and Fig.1). it clearly observed that net returns in wheat were affected to a great extent by weed management practicesduring both the years of trials as well as in pooled mean. Providing the highest net return treatment T2 (Carfentrazone-ethyl 20 gma.i./ha (25-30 DAS)of Rs 101700/haover farmers practices (Rs. 84325). It provided additional net returns of Rs 17375/hawith B:C ratio of 4.66. The higher cost of cultivation Rs 27650/ha) observed in On Farm Trial of wheat crop as compared to farmers' practices (27350).The T2 plots have higher mean gross return (Rs 129350/ha) as compared to farmers' practices (111625). Hence, favourable B:C ratio proved the intervention made under in On Farm Trial and convinced the farmers on the utility oftechnology. The higher net returns and B:C ratioin the demonstrations on improved technologiesas compared to farmers' practices and at par with results of present study was also reported by Sreelakshmi *et al*. 2012 and Joshi *et al*. 2014.The farmers' feedback were collected on assessed technology after conducted OFTs for two years trialsand its mentioned in Table 6. These observation find out that 80 per cent adaptability, 85 per cent assessed technology acceptance to the farmers, 75 per cent compatibility to farming system components, 75 per cent compatibility to household internal resources and 80 per cent affordability on farmers reactions on assessed technology (Carfentrazone ethyl @ 20 g/ha (25-30 DAS)

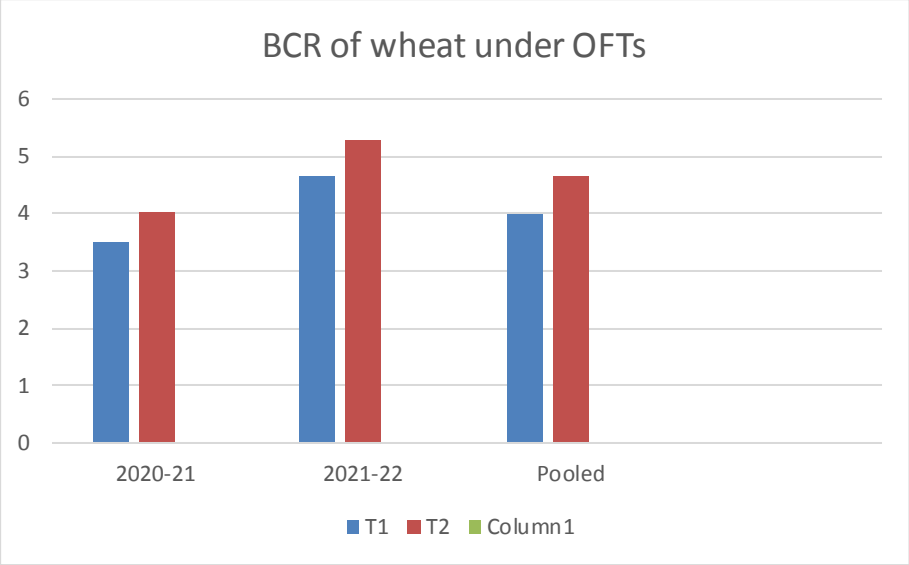

Fig 1.BCR of wheat under On Farm Trial in in Jodhpur districtof Rajasthan

Fig 2. Performance of foliar spray of Carfentrazone-ethyl 20 gma.i./ha at 25-30 DAS in wheat under On Farm Trial in Jodhpur district of Rajasthan (T2)

CONCLUSION

It may be concluded that the yield and net returns in wheat increased statistically with improved technologies. However, the yield levels under On Farm Trial was better as compared to farmers' practices.The OFTsalso strengthened the interactions and trust between farmers and KVK scientists. It was also concluded that besides other practices of weed management, insectpest management, and water stress are to be given for attention to enhancingwheat production in the area. This will subsequently increase the income as well as the livelihood of the farming community of the Jodhpur district.

Table 1. Major weed flora in the On farm trial fields during 2020-21 and 2021-22

S.No.	Botanical name	Common name	English name	Family name	Growth habit
1.	*Chenopodiumalbum* L	Bathua	Lambsquarter	Chenopodiaceae	AD RS
2.	*Chenopodiummurale* L.	Khartua	Goosefoot	Chenopodiaceae	AD RS
3.	*AsphodelustenuifoliusCavan*	Piazi	Wild onion	Liliaceae	AM RS
4.	*Rumexdentatus* L.	Janglipalak	Sour dock	Polypogonaceae	AM RS
5.	*Cynodondactylon*L.	Doob grass	Bermuda grass	Poaceae	PM RS & RV
6.	*Anagallisarvensis*L.	Krishnaneel	Pimpernel	Primulaceae	AD RS
7.	*Convolvulus arvensis*L.	Hirankhuri	Field bind weed	Convolvulaceae	AD RS & RV
8.	*Launeaasplenifolia*L.	Jangligobhi	Wild gobhi	Asteraceae	AM RS
9.	*Cyperusrotundus*L.	Motha	Purple nutsedge	Cyperaceae	PM RS & RV
10.	*Phalaris minor* Retz.	Gullidanda	Little seed canary grass	Poaceae	AM RS

Table 2. Effect of weed managementstreatments on plant stand (per metre row length) and plant height (cm) of wheat at different stages

Treatments	Plant stand at 40 DAS			Plant standat harvest			Plant height at 40 DAS			Plant height at harvest		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1	13.6	14.4	14.0	12.4	12.7	12.6	23.4	25.6	24.5	95.7	97.5	96.6
T2	13.8	14.6	14.2	12.6	13.2	12.9	23.7	26.2	25.0	106.8	109.5	108.1

Table 3. Effect of weed managementstreatments on yield attributes of wheat during 2020-21 and 2021-22

Treatments	Total tillers/plant			Effective tillers/plant at harvest			Spike length (cm)			Grains/spike		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1	7.60	7.68	7.64	5.35	5.40	5.37	7.42	7.48	7.45	38.46	38.56	38.51
T2	7.90	8.10	8.00	5.95	5.99	5.97	7.73	7.75	7.74	38.66	39.19	38.93

Table 4. Impact of weed managementstreatments on grain, straw and biological yields (q/ha) and harvest index (%)

Treatments	Grain yield			Straw yield			Biological yield			Harvest index (%)		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1	35.6	35.9	35.7	47	48.5	47.7	82.6	84.4	83.4	43.09	42.53	42.80
T2	41.53	42.1	41.8	54.5	54.0	54.2	96.03	96.1	96.0	43.24	43.80	43.54

Table 5. Impactof weed managements treatments on economics on wheat during 2020-21 and 2021-22

Treatments	Gross cost			Gross returns			Net returns			B: C ratio		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T1	27,000	27,600	27,300	94,700	1,28,550	111625	67700	1,00,950	84325	3.50	4.65	4.07
T2	27,300	28,000	27,650	1,10,250	1,48,450	129350	82,950	120450	101700	4.03	5.30	4.66

Table 6. Observation on farmers feedback on assessed technology (Carfentrazone ethyl @ 20 g/ha at 25-30 DAS

SNo	Particulars	Percent
1	Adaptability	80
2	Level of assessed technology acceptance to the farmers	85
3	Compatibility to farming systemcomponents	75
4	Compatibility to household internal resources	75
5	Affordability	90

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