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Evaluation of Frontline Demonstration of Zero Tillage Technology in Wheat Under Semi-Irrigated Conditions

Ajay Chourasiya, Uttam Kumar Tripathi and Ashok Kumar Sharma

Deendayal Research Institute-Krishi Vigyan Kendra Satna- 485331 (Madhya Pradesh)

ABSTRACT

Krishi Vigyan Kendra Satna conducted frontline demonstrations on sowing of wheat by zero tillage method at farmers' field during years 2019-20 and 2020-21. The data on productivity, economics and water saving in demonstrated plots were calculated and compared with the corresponding farmer's practice. It was observed that yield of demonstrated plots was 15.73 per cent higher than farmer's practices. The extension gap, technology gap and technology index were 5.99 q/ha, 2.93 q/ha and 6.23 per cent, respectively. Due to reduced cost of cultivation and higher crop yield, the gross and net return was also higher in zero tillage as compared to the farmer's practice. The BCR was 2.78 in zero tillage, which was higher than in farmer's practice (2.08). The depth of irrigation was also less, *i.e.,* 22.20 ha-cm and 30.50 ha-cm in zero tillage and farmer's practice, respectively. Higher yield and returns due to reduced cost of cultivation and water saving in the FLDs over the farmer's practice created greater awareness and motivated the other farmers to adopt this latest wheat sowing technology.

Key Words: Irrigation, Returns, Wheat, Yield, Zero tillage.

INTRODUCTION

Wheat is the second most important cereals after rice and consumed as principal food at global level. In Madhya Pradesh it is grown on 5.52 m ha area with production 15.47 mt and productivity of 28.02 q/ha (DAC, 2019). India's per capita production is 67 kg against per capita consumption of 73 kg/ year. Thus, around 15 mt of wheat production has to be increased by adopting improved production practices. In Madhya Pradesh, many farmers grow late-maturing varieties of rice, causing late sowing of wheat.

The delay of every successive day in planting beyond November third week decreases the grain yield. Therefore, to avoid delay in planting and reduce the cost of production, farmers have started adopting resource conserving technologies such as zero tillage and surface seeding in wheat production (Gupta and Seth, 2007) and rapid and widespread adoption of Zero Tillage (ZT) has been started in Madhya Pradesh from 2001 Laxmi *et al* (2007). Savings in input cost, fuel consumption and irrigation water-use have been reported due to the adoption of zero tillage in wheat cultivation Malik *et al* (2003).

Despite the documented positive agronomic, economic and environmental impacts, conservation tillage under wheat has not yet become widely popular in many parts of Satna. For its horizontal expansion, it was planned to conduct front line demonstration of this innovative sowing method. The present study has been undertaken with the objectives to study the differences between demonstrated packages of practices vis-à-vis practices followed by the local farmers (farmers' practices) in terms of extension gaps/technology gaps.

MATERIALS AND METHODS

Frontline demonstrations (FLD) were conducted for two consecutive years during *Rabi* seasons 2019-20 and 2020-21 at farmer's fields

Corresponding Author's Email: ajaychourasiya09@gmail.com

Table 1. Details of wheat grown under FLD and farmer practice.

Sr. No.	Particular	Frontline demonstration	Farmer practice
1.	Variety	JW 3288	Lok 1
2.	Seed rate (kg/ha)	100	120
3.	Seed treatment	Carboxin+ thiram @ 2 g/kg seed	No.
4.	Sowing method	Zero tillage sowing after harvesting of paddy	Conventional tillage *i.e.* 2 disking + 2 cultivator + 2 planker + seed drill + planker
5.	Sowing date	10th to 15th November	25th November to 05th December
6.	Fertilizer application N:P:K (kg/ha)	120:60:40	175:25:0
7.	Weed control	Less emergence and easy to control through single application of weedicide	More emergence and difficult to control even with higher doses of weedicides
8.	Plant protection measures	Need based spray of insecticides and fungicides	Over dose/ un recommended brands of insecticides and fungicides

of Majhgawan block of Satna district to validate impact of frontline demonstration of Zero tillage technology of wheat under semi-irrigated condition in rice-wheat cropping sequence. 13 FLDs were conducted at randomly selected farmer's fields in Majhgawan in Satna district of Madhya Pradesh. Geographically Satna is situated in the Satpura and Kaymore Plateau range and lies at 24^0 51' 15" to 24^0 57' 30" N latitude and 80^0 43' 30" to 80^0 54' 15" E longitude at the elevation of 313 m from mean sea level. The location has subtropical climate characterized by hot dry summer and cool winter. The soil of the farmer's fields was sandy loam in texture with shallow in depth and soil was very low in available nitrogen, low in available phosphorus and higher in available potassium. Soil reaction was almost neutral. The conventional rice-wheat rotation was being followed on the field from last 15 years. Each demonstration was of 0.4 ha area and wheat seed and zero tillage seed drill was supplied as critical input for partial fulfilment and other inputs were applied as per the recommendation and wheat variety JW 3288 was most commonly grown at their fields. The sowing of wheat was done during 10th November to 15th November in zero tillage, whereas it was sown from 25th to 05th December in conventional tillage (farmer's practice) and harvested during mid of April. The total of 13 frontline demonstrations in 5.2 ha was conducted at farmers' field in different villages of district Satna. Along with frontline demonstrations (FLD), practicing farmer training on calibration, operation and maintenance of zero tillage seed drill was also imparted. All fertilizers were drilled at the time of sowing in demonstrated fields, whereas, it was broadcast in farmers' practice. Two irrigations were given to crop in zero tillage, while in addition to this three irrigation in conventional tillage fields, one pre-sowing irrigation was also given. The farmer practices were maintained in case of local check. The data were collected from both improved practices as well as farmer practices and finally the extension gap, technological gap, technological index along with the benefit-cost ratio were calculated (Samui *et al*,2000).

RESULTS AND DISCUSSION

Grain Yield

The crop from all the plots was harvested under the supervision of the KVK scientists. The yield from both the plots *i.e.,* demonstration and farmers' practices were compared and it was evident that an average yield of demonstrated plots was 15.73 per cent higher than that of farmer's practices (Table2). The grain yield under demonstrated plots were 42.05 and 46.09 q/ha with an average of 44.07 q/ha from the year 2019-20 and 2020-21. However, it was 38.10 and 38.06 q/ha with an average of 38.08 q/ha under farmer's practice. The highest increase in grain yield (21.10 %) was observed in the year 2020-21. The reasons behind the increase of yield under demonstrated plots might be due to timely sowing and adoption of other recommended technologies about which the farmers were ignorant. Meena *et el* (2016) also observed the higher wheat yield in zero tillage as ZT wheat farmers could sow the crop much earlier than their conventional counterpart and early sowing is associated with higher yield, a significant and positive yield impact (Increased by 15.73%) observed in the study area. In southeastern conditions of Turkey conditions, it has been found that no tillage had resulted into lowest fuel consumption and maximum field efficiency and concluded that and corn can also be sown after lentil with conservation tillage and direct seeding Sessiz *et al* (2010).

Extension Gap

An extension gap between demonstrated technology and farmers practices was also calculated and on an average basis, the extension gap of 5.99 q/ha was calculated (Table 2). This gap might be attributed to the adoption of improved technology practices such as proper seed rate, use of seed treatment material, nutrient management, pest management etc. in demonstrated plots which resulted in higher grain yield than the traditional farmers, practices. On the basis of the extension gap, the farmers were motivated to adopt the recommended package of practices to reduce the extension gap and to increase their grain yield.

Technology Gap

The technology gap was calculated by deducting the demonstrated plot yield from the potential yield of the wheat crop. The recorded technology gap was 4.95 and 0.91 q/ha during the study period. The average technology gap was found 2.93 q/ha. The difference in technology gap during two years could be due to more feasibility of recommended technologies like sowing time, seed rate, seed treatment, nutrient management and plant protection measures especially IPM. Higher technology index reflected the inadequate proven technology for transferring to farmers and insufficient extension services for transfer of technology.

Economic Analysis and Water Saving

The cost of cultivation (Rs/ha) during the year 2019-20 to 2020-21 was 30,406/- and 30,500/-, respectively in zero tillage sown wheat. While it was 34,414/- and 35,355/- in conventionally sown fields (Table 3). Particularly in conventional sowing due to more number of tillage operations, the average higher cost of cultivation in conventional sown field was 4,432/- (Rs/ha). Due to reduced cost of cultivation and higher crop yield, the gross and net return was also higher in zero tillage as compared to the conventional sowing. The BCR was 2.54 and 2.98 in zero tillage, which was higher than in conventional sowing 2.04 and 2.13, respectively.

On waterfront, zero tillage technology consumes less water as one pre-sowing irrigation does not require. In addition to this during the average time for irrigation were 7.65 hr/ha and 9.50 hr/ha in zero tillage and conventional sowing respectively. Consequently, the depth of irrigation was also less in zero tillage as compared to conventional sowing *i.e.,* 22.20 ha-cm and 30.50 ha-cm, respectively in zero tillage and conventional sowing. Raju *et al* (2012) and Tripathi et al (2013) also reported saving in input cost and irrigation water use in zero tillage wheat cultivation.

Table 2. Grain yield and gap analysis of FLDs and farmer practices

Year	Yield (q/ha)		Increase (%)	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
	Demo	FP				
2019-20	42.05	38.10	10.37	3.95	4.95	10.53
2020-21	46.09	38.06	21.10	8.03	0.91	1.94
Average	44.07	38.08	15.73	5.99	2.93	6.23

Table 3. Economic analysis and water saving in demonstrated plots and farmers' practice

Year	Cost of cultivation (Rs/ha)		Gross returns (Rs/ha)		Net return (Rs/ha)		B:C ratio		No. of irrigation (no.)		Depth of irrigation (ha-cm)		Irrigation water saved (%)
	Demo	FP	Demo	FP	Demo	FP	Demo	FP	Demo	FP	Demo	FP	
2019-20	30406	34414	77372	70104	46966	35690	2.54	2.04	2	3	22.15	30.45	37.47
2019-21	30500	35355	91028	75169	60528	39814	2.98	2.13	2	3	22.25	30.55	37.30
Average	30453	34885	84200	72636	53747	37752	2.76	2.08	2	3	22.20	30.50	37.39

CONCLUSION

In the present scenario of rising inputs cost and labour shortage in agriculture, farmers need input saving alternative technologies to sustain crop production. In zero tillage wheat cultivation, both yield and net returns were 31.59 and 52.03 per cent higher than conventional wheat sowing. Similarly average 37.39 per cent irrigation water was saved in zero tillage. The increase in yield of wheat to the extent of FLDs over the conventional sowing created greater awareness and motivated the other farmers to adopt this latest wheat sowing technology. The beneficiary farmers of FLDs also play an important role as a source of information. The concept of frontline demonstrations may be applied to all farmer categories including progressive farmers for speedy and wider dissemination of the recommended practices to other members of the farming community.

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Evaluation of Maize Based Legume Intercropping Systems

N. Khumdemo Ezung, D J Rajkhowa and Ben Yanthan

KVK Kiphire
ICAR for NEH Region, Nagaland, Kiphire 798611 (Nagaland)

ABSTRACT

A field experiment was conducted during the *kharif* season of the year 2021 at the experimental farm of Krishi Vigyan Kendra, Kiphire, Nagaland to assess the response on growth and yield of maize crop as affected by different intercropping systems. The experiment was laid out in randomized block design with seven treatments and three replications. The treatments included sole maize (T1), maize + greengram (T2), maize + french bean (T3), maize + groundnut(T4), maize + cowpea (T5), maize + rice bean (T6) and maize + blackgram (T7). It was found that the growth and yield of the sole crop out-performed the rest of the intercropping system. However, in inter-cropping system, maize + cowpea intercropping produced the highest growth, yield, net income and B:C ratio as compared with the rest of the intercropping system. However, the maize equivalent yield was found to be highest in maize+groundnut system followed by maize+cowpea. It can be said that intercropping of maize with cowpea followed by maize+ groundnut may be considered for adoption by farmers' of Kiphire district. The intercropping of maize + greengram and maize+blackgram which resulted in the B:C ratio of 3.37 may also be considered for taking up depending on market availability and demand.

Key Words: Growth, Intercropping, Legumes, Maize, Yield.

INTRODUCTION

Maize (*Zea mays* L.) is the third most important food grain crop in India next to rice and wheat. Intercropping of maize with legumes is one of the ways to improve and stabilize the productivity of maize. Intercropping in maize with short duration legumes or oilseeds offers the potential to obtain high productivity and profitability at low water use without reducing its own yield (Sharma *et al*, 2013).

Intercropping provides insurance against crop failure or unstable market prices for a given commodity. Inclusion of legumes as intercrop, not only provides nitrogen to the base crop but also increases the amount of humus in the soil due to decaying crop remains Kheroar Patra (2013). Intercropping system is a well developed technology for monoculture and will no longer be just a poor man's practice. Thus, various evidences suggest that intercropping can in fact; provide a substantial yield advantage compared to sole cropping and is recognized as a beneficial system of crop production. Various experiments have indicated that legumes have more advantages when intercropped with maize due to its greater land-use efficiency per unit area, higher yield, fixation of atmospheric nitrogen and sharing complimentary effects between the component crops.

Black gram (*Vigna mungo* L.) is one of the most important compatible intercrop with maize. Green gram (*Vigna radiata* L.) inclusion an intercrop in maize improved the soil focalizations of N, mineral composition of soil culture and soil fertility (Dahmardeh *et al*, 2013). Cowpea (*Vigna unguiculata* L.) is used as tender pods as vegetables and dry bean as pulse. Shade tolerance is important characteristic of cowpea which makes it a compatible intercrop with maize, sorghum as well as with several plantation crops Singh and Pareek (2003). Groundnut (*Arachis hypogaea* L.) plants

Corresponding Author's Email: kvkkiphire2017@gmail.com