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A COMPARISON OF CONSERVATION TECHNOLOGIES AND TRADITIONAL TECHNIQUES FOR SOWING OF WHEAT

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ABSTRACT

The conservation technologies and traditional techniques were evaluated at Adaptive Research Farm Gujranwala Pakistan during Rabi 2007-2008 and 2008-2009. The sowing techniques evaluated were broadcasting (T-1), Rotary Tillage Drill (T-2), Zero Tillage Drill (T-3) and Rabi Drill (T-4). Rotary Tillage Drill showed significantly high germination count (220.50 m^{-2}) followed by Rabi Drill (211.50 m^{-2}), Zero Tillage Drill (195.34 m^{-2}) and broadcasting (182.84 m^{-2}), respectively. Rotary Tillage Drill (T-2) produced maximum number of grains $spike^{-1}$ (52.61) which was significantly high as compared to Rabi Drill (48.11), zero tillage drill (45.55) and broadcasting (41.77). Similarly Rotary Tillage Drill produced highly significant effect on grain yield (4.71t ha^{-1}) as compared to other treatments i.e. 3.75, 3.04 and 2.61 t ha^{-1} in case of Rabi Drill, Zero Tillage Drill and broadcasting, respectively. Rotary tillage drill (T-2) gave maximum net income (Rs.36442 ha^{-1}) with a CBR of 1:12.80 compared with rabi drill (T-3) net income Rs. 15892 ha^{-1} with CBR 1:6.80 and zero tillage (T-4) i.e. Rs.8610 ha^{-1} with CBR 1:5.00 over broadcasting method.

Key words: Conservation Technologies, Broadcasting, save time, energy, CBR, Pakistan.

INTRODUCTION

Farm mechanization saved labour and time but increased the energy bill of the farmers. In the year ahead there would be steep increase in the energy demand of agriculture. Therefore, a need was developed to optimize the energy usage by improving tillage practices and developing efficient tillage operations for sowing of wheat crop. In rice-wheat cropping system late maturity of rice particularly Basmati Super delayed the sowing of wheat. The sowing of wheat is further delayed due to pre-sowing irrigation followed by land preparation that takes another 7-10 days depending upon the prevailing climatic conditions. Rotary drill not only helps in advancing the sowing of wheat but also save the energy required for tillage operation to prepare a fine seed bed (Yadav, 1998). Therefore, to achieve sustainable and higher productivity, efforts must be focused on reversing the trend of natural resource degradation. Moreover, due to rising prices of inputs, it is imperative to develop technologies which could save inputs and hence increase the profit margins of the farmers (Sharma *et. al*., 2008). Conservation tillage practice is attractive source to farmers because the potential of reduction of production costs compared to conventional method of sowing (Botta *et. al*., 2006). Maximum increase in fuel consumption reduced the economic benefit of the farmers, so that tillage equipments are used in sowing of wheat. In case of zero tillage technique there is no need of soil preparation, it operates on fellow land at watter condition. The drawback of this equipment is that, maximum yield is obtained in first year but next year yield of crop is reduced because of soil compaction. By using rotary tillage drill wheat sowing can be done in single pass i.e. optimizing energy, saving valuable time and reducing the total cost of production. These techniques are great importance for livelihoods and food security of millions of people residing within and outside Pakistan. Extending resource conserving technologies developed for wheat and rice culture, however still remains a major challenge for the researchers and the farmer's alike (Chauhan *et. al.*, 2003). Keeping in view the conservation of energy resources, the present study was undertaken to compare conventional sowing method and through rotary drill at A. R. Farm, Gujranwala.

MATERIALS AND METHODS

The conservation technologies and other traditional techniques were evaluated at A. R. Farm Gujranwala Pakistan during Rabi 2007-2008 and 2008-2009. The Rotary Tillage Drill is a machine in which tines just like Rabi Drill are attached behind the rotavator. Rotavator pulverized the soil upto 3-4 inches and seed are properly placed at the required depth. It is a very good implement that not only save energy but make possible proper sowing of wheat crop in one pass. Rabi Drill is used after well prepared soil along with planking, so its costly technique. Zero Tillage Drill is used for direct sowing of wheat on un-ploughed soil in watter condition. The experiment was laid out in RCBD with three replications using a net plot size of 3m x 5m. Previous crop was rice in the field where experiment was conducted. The wheat variety Sehar-2006 was used as

medium and it was sown on 25th of November each year. The recommended dose of NPK i.e. 158:114:62 kg ha^{-1} was applied in the experiment. All the agronomic practices and plant protection measures were kept constant to avoid biasness.

RESULTS AND DISCUSSION

Germination Count (GC m^{-2}): From the data (Table-1) it is clear that Rotary Tillage Drill (T-2) showed significantly higher germination count (236.67 and 204.33) followed by Rabi Drill (T-4), Zero Tillage Drill (T-3) and Broadcasting (T-1) i.e. (227.00, 206.00), (215.00, 205.00) and (213.00, 197.00 m^{-2}) respectively in both the years 2007-08 and 2008-09. Our results are contradictory to (Zamir *et. al*., 2010) who gave maximum GC in zero tillage (192.47 to 194.60 m^{-2}) but in accordance to zero tillage techniques.

Spike Length (cm): It is revealed from data (Table-1) that Rotary Tillage Drill (T-2) depicted a significant effect on spike length 9.00cm & 8.90cm followed by Rabi Drill (T-4) 8.55 cm & 8.36cm, Zero Tillage Drill (T-3) 8.50cm & 8.26cm and broadcasting (T-1) 8.25cm & 7.67cm respectively during both the years. Good soil tilth developed by rotary tillage gave better development of roots and ultimately spike length was increased. Our results of the experiment were supported Sharma *et. al*., (2008) who recorded spike length maximum upto 9.53cm during 2005-06.

Productive Tillers (m^{-2}): Data given in table-1 showed that rotary tillage drill (T-2) produced significantly more productive tillers (347.94, 348.07) as compared to rest of the treatments during both the years. Other treatments produced productive tillers (337.2 and 331.12) by zero tillage drill, (341.12 and 344.5) by rabi drill, (325.33 and 278.20) by broadcasting during both the years respectively. Our results of this experiment are in contrast with Abbas *et. al*., (2009) who obtained maximum tillers in broadcasting method over all other techniques. Soil preparation was better with rotary tillage as compare to other tillage implements, which resulted in best nutrient uptake and finally higher number of productive tillers were produced. Lupton *et. al.,* (1974) studied root growth of several cultivars of winter wheat, he reported in his experiment that better development of root gave better genetic makeup of plant material and ultimately produced maximum number of productive tillers.

Table. 1. Response of different tillage equipments on germination count (m2), Spike Length (cm) and Productive tillers/m2 of wheat during 2007-08 and 2008-09

Tillage Operations	Germination Count/m2			Spike Length (cm)			Productive tillers/m2		
	2007-08	2008-09	Mean	2007-08	2008-09	Mean	2007-08	2008-09	Mean
T-1 (Broadcasting)	213.00cd	152.67d	182.84d	8.25b	7.67c	7.96c	325.33b	278.20c	301.77d
T-2 (Rotary Tillage Drill)	236.67a	204.33a	220.50a	9.00a	8.90a	8.95a	347.94a	348.07a	348.01a
T-3 (Zero Tillage Drill)	215.67c	175.00c	195.34c	8.50b	8.26b	8.38b	337.20a	331.12b	334.10c
T-4 (Rabi Drill)	227.00b	196b	211.50b	8.55b	8.36b	8.46b	341.12a	344.50a	342.81b
LSD	5.2964	4.7830	5.0397	0.3069	0.2363	0.2716	11.469	6.1335	8.8013

Means sharing a letter in a column did not differ significantly (P<0.05)

No. of grains (SPIKE^{-1}): The statistical data (Table-2) showed that maximum number of grains per spike was recorded by rotary tillage drill (52.61) followed by rabi drill (48.11), zero tillage drill (45.55) and broadcasting (41.77). The results of experiment are in accordance with Zamir *et. al*., (2010) who gave grains in range 49.40 to 51.80 $spike^{-1}$. Our results of broadcasting technique are in line with Abbas *et. al*., (2009) who obtained 42.64 grains in a single spike.

1000 grain weight (g): From the data table-2 it is clear that during the year 2007-08 and 2008-09, maximum 1000 grain wt. was produced (42.39 and 39.86) which is same with each other but differ significantly from all other treatments. This increase in 1000 grain weight is attributed due to better soil preparation, root development and ultimately more uptake of nutrients. These results are in contradictory with Abbas *et. al*., (2009), Zamir *et. al*., (2010) and in accordance with Soomro *et. al*., (2009), Nasrullah *et. al*., (2010) and Khan *et. al*., (2007).

Grain yield (t/ha): The data (Table-3) showed that grain yield differ significantly from each other during both the years of study. The highest grain yield 4.71 t ha^{-1} and 3.75 t ha^{-1} were obtained in case of rotary tillage drill (T-2) and rabi drill (T-4) during 2007-08 and 2008-09 respectively followed zero tillage drill (T-3) and broadcasting (T-1). This increase in grain yield may be attributed due to good soil tilth and better resource

utilization in rotary tillage drill (T-2) that pulverize the soil and resulted in better uptake of nutrients. Similar trend of results were obtained by Zamir *et. al*., (2010), Sharma *et. al*., (2008) who showed satisfactory performance of rotary disc drill in the rice stubbles and showed maximum yield 4.42 t ha^{-1} during 2004-05 and in contrast with Abbas *et. al*., (2009) and Rehman *et. al*., (2010). Better root development was resulted in better uptake of nutrient that ultimately resulted in increase in crop productivity and yield (Izumi *et. al*., 2004 and Merril *et. al.,* 1996).

Economic Analysis: The economic analysis showed that rotary tillage drill (T-2) is most economical technique as compared to Rabi Drill, Zero Tillage Drill and broadcasting method (Table 3). Among these techniques rotary tillage drill is better technique, because it is economical, time and energy saving, but also ensure timely sowing of wheat and produced better yield. The method of calculation of economic analysis was used in this experiment followed by Chaudary *et. al*., (2011). Rotary tillage drill (T-2) gave maximum net income (Rs.36442 ha^{-1}) with CBR of 1:12.80 compared with rabi drill (T-4) Rs. 15892 ha^{-1} with CBR 1:6.80 and zero tillage (T-3) Rs.8610 ha^{-1} with CBR 1:5.00. Our results are in accordance with Sharma *et. al.,* (2008). Hence the results of this experiment showed that conservation tillage can help to minimize environmental problems, improve crop productivity and increase the sustainability in rain-fed agriculture reported by Li *et al.* (2004) and (2005).

Table. 2. Response of different tillage equipments on No. of grains spike^{-1} and 1000 grain wt. (g) of wheat during Rabi 2007-08 and 2008-09

	No. of grains /spike			1000 grain wt (g)		
Tillage Operations	**2007-08**	**2008-09**	**Mean**	**2007-08**	**2008-09**	**Mean**
T-1 (Broadcasting)	47.22d	36.32d	41.77d	36.17c	34.86c	35.52c
T-2 (Rotary Tillage Drill)	57.44a	47.78a	52.61a	42.39a	41.46a	41.93a
T-3 (Zero Tillage Drill)	50.48c	40.61c	45.55c	38.74b	37.87b	38.31b
T-4 (Rabi Drill)	53.44b	42.78b	48.11b	40.71ab	39.49ab	39.86ab
LSD	1.8526	2.1509	2.0018	2.3227	2.5382	2.4305

Means sharing a letter in a column did not differ significantly (P<0.05)

Table 3. Grain yield and yield components of wheat crop as affected by different Tillage Techniques during 2007-08 and 2008-09

Tillage Operations	**Grain yield t/ha**		**Avg. Yield (t $ha^{-1)}$**	**Increase in yield over control (t ha^{-1})**	***Additional income over control (Rs. ha^{-1})**	**Extra cost of labour/ Equipment (Rs.ha^{-1})**	**Net Profit (Rs.ha^{-1})**	**Cost Benefit Ratio**
	2007-08	**2008-09**						
T-1 (Broadcasting)	2.32d	2.89cd	2.61d	-	-	-	-	-
T-2 (Rotary Tillage Drill)	4.49a	4.92a	4.71a	2.10	33600	-2842	36442	1:12.8
T-3 (Zero Tillage Drill)	3.11c	2.96c	3.04c	0.43	6880	-1730	8610	1:5.00
T-4 (Rabi Drill)	4.2b	3.29b	3.75b	1.14	18240	2384	15892	1:6.80
LSD	0.2579	0.2063	0.2321					

*Calculation based on wheat @ Rs. 16 kg^{-1}

Means sharing a letter in a column did not differ significantly (P<0.05)

Conclusion: As timely sowing of wheat is a major problem in Rice-Wheat cropping pattern. So that the rotary tillage drill is a good option for growers of rice tract, as it ensures timely sowing of fine rice and gives maximum yield as compared to all other techniques. On the other hand Rotary tillage drill not only ensures maximum yield but also save fuel, energy, time of sowing hence it is a most profitable practice.

REFERENCES

Abbas, G., M. A. Ali, G. Abbas, M. Azam and I. Hussain (2009). Impact of planting methods on wheat grain yield and yield contributing parameters. The J. Anim. Plant Sci., 19(1):30-33.

Botta, G. F., D. Jorajuria, H. Rosatto and C. Ferrero (2006). Light tractor frequency on soil compaction in the Rolling Pampa of Argentina. Soil Tillage Res. 86:9–14.

Chauhan, D. S., R. K. Sharma, and R. S. Chhokar, (2003). Comparative performance of tillage options in wheat (*Triticum aestivum*) productivity and weed management. Ind. J. of Agri. Sci. 73(7): 402-406.

Izumi, Y., K. Uchida and M. Iijima (2004). Crop production in successive wheat-soyabean rotation with no-tillage practice in relation to root system development. Plant Prod. Sci. (7):329-336.

Khan, A., M. Arif, A. Shah, S. Ali, Z. Hussain and S. Khan (2007). Evaluation of planting methods for grain yield and yield components of wheat. Sarhad J. Agric. 23(3):561-563.

Li, L. L., G. B., Huang and R. Z. Zhang (2004). Conservation tillage development research on the Western Loess Plateau of Gansu Province. In "Food Security and Farming Systems" (W Gao, ed.),. Hunan Sci & Tech Press, Changsha pp. 185-188

Li, L. L., G. B. Huang, R. Z. Zhang, X. J. Jin, G. D. Li, K. Y. Chan (2005). Effects of conservation tillage on soil water regimes in rainfed areas. Acta Ecol. Sinica (25): 2326-2332.

Lupton, F. G. H., R. H. Oliver, F. B. Ellis, B. T. Barnes, K. R. Howse, P. J. Welbank and P. J. Taylor (1974). Root and Shoot growth of semi-dwarf and taller winter wheat. Ann. Appl. Biol. (77):129-144.

Merrill, S. D., A. L. Black and A. Bauer (1996). Conservation tillage affects root growth of dryland spring wheat under drought. Soil Sci. Soc. Am. J. (60):575-583.

Nasrullah, M. H., M. S. Cheema and M. Akhtar (2010). Efficacy of different dry sowing methods to enhance wheat yield under Cotton-Wheat cropping system. Crop and Env. 1(1) :27-30.

Sharma, R. K., R. S. Chhokar, R. K. Singh and S. C. Gill (2008). Zero tillage wheat and unpuddled rice: the energy, labour and cost efficient alternatives to conventional rice-wheat system. Proceedings of the "14th Australian Agronomy Conference" (MJ Unkovich), Adelaide, South Australia pp 147-158.

Rehman, M. A., S. J. Hossain, M. B. Hossain, M. R. Amin and K. K. Sarkar (2010). Effect of variety and culture method on yield and yield attributes of wheat. Int. J. Sust. Crop. Prod. 5(3):17-21.

Sana Ullah Ch., M. H. Kahloon and J. Iqbal (2011). Effect of different herbicides on weed control and yield of Canola (Brassica napis L.). J. Agric. Res. 49(4):483-490.

Soomro, U. A., M. U. Rehman, E. A. Odhano, S. Gul and A. Q. Tareen (2009). Effect of sowing method and seed rate on growth and yield of wheat (Triticum aestivum). World J. Agri. Sci. 5(2) :159-162

Yadav, R. L. (1998). Factor productivity trends in a rice-wheat cropping system under long-term use of chemical fertilizers. Exp. Agri. (34): 1–18.

Zamir, M. S. I., A. H. Ahmad and M. A. Nadeem (2010). Behavior of various wheat cultivars at tillage in Subtropical Conditions. Cercetari Agronomice Moldova Vol. XLIII, 4(144): 13-19.