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Energy management and cost of cultivation of wheat crop in dryland condition

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ABSTRACT : In case of dryland cultivation practices intelligently on need to minimize cost of production of any crop. Tillage is one of the major operations of the crop production and is an important contributor to the total cost of production. In this regards an experiment has been conducted on two tillage system *i.e.* conventional and reduce tillage system in order to save the energy in production of wheat crop comprising three tillage treatments in combination to three doses of fertilizer application. The data revealed that the highest yield of wheat of 29.33q/ha was recorded in 50% conventional tillage + weedicide + interculture followed by conventional tillage + interculture with a grain yield of 27.87q/ha. With regard to nitrogen application through different sources, the highest average grain yield of 29.00q/ha was recorded with 100%N through inorganic fertilizer followed by 50% N through organic + 50% N through inorganic fertilizers with a grain yield of 28.25q/ha. As for as energy requirement and cost of operation were higher in the conventional tillage system (2907.53MJ and Rs.11347.33) than in reduce tillage *i.e.* 50% CT+ interculture+ weedicide (2227.20MJ and Rs.10335.30) and 50% CT+ interculture (2281.56 MJ and Rs.9948.60), respectively. The benefit cost ratio ranged from 1.08: 1 to 1.41: 1.

KEY WORDS : Tillage, Wheat, Reduce tillage, Fertilizer, Energy, Conventional tillage

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Wheat (*Triticum aestivum*) is a main cereal crop in dryland area of Jammu division of J&K state. It has special importance in hilly and sub mountainous region of Jammu division where it forms staple diet of the people. It occupies highest area under cultivation in the state in *Rabi* season. Crop cultivation involves intensive tillage, which consumes major portion of energy and cost. Energy in terms of human, mechanical and chemical is used mainly for agricultural operation such as planting, fertilizer application harvesting and transportation and it is directly related to production per worker, per man and indicates the level of prosperity achieved by any country. The rising cost of fuels, their non-availability and the knowledge that they are non-renewable along with the availability of herbicides coupled with the motive of reducing the cost of production has provided enough incentive to researchers to investigate tillage operation more closely. Nielsen (1990) reported that labour requirement could be reduced by 55-65% in reduce tillage compared with conventional methods and fuel consumption also felt from a maximum of 49 l/ha for ploughing to minimum of 18 l/ha for direct drilling. Continuous application of high amount of only in organic fertilizer had effects leading to decline in productivity due to limitation of one or more of the micro nutrients (Nambiar and Abrol, 1989). Application of organic manure with inorganic fertilizer to integrated nutrient supply has shown encouraging results on crop production as well as soil health (Pathak *et al*., 2002). Organic materials have the capacity to improve hydro physical environment, nutrient use efficiency and fertility status of soil and sustainable crop production thereby increasing benefit cast ratio (Wani *et al*., 1994). Integrated supply of nutrients through organic and inorganic sources is a better option for sustainable crop production in the different agro- ecological regions of country (Swarup, 1988). The highest maize yield 20.50 q/ha was found with conventional tillage + interculture which was at par with 50% conventional tillage + weedicide + interculture with a grain yield of 20.16q/ha (Singh *et al*., 2009). Keeping this in view an experiment was conducted in research field to asses the impact of energy management *i.e.* reduce tillage system and

nutrient management on crop yield.

METHODOLOGY

Experiments were conducted at the project farm of Dryland Research Sub station, SKUAST-Jammu, located at the Pathankot-Jammu National Highway. The project farm is situated at latitude of 32^0 39' North and longitude of 74^0 53' East at an elevation of 332 meters above the mean sea level. The project farm represents the true kandi belt of Jammu plain areas and part of Kathua and Udhampur districts of Jammu province. To work out appropriate practices for the success of minimum till system using conventional and reduce tillage farming system in dryland condition *viz.*, conventional tillage+ interculture, 50% conventional tillage + interculture and 50% conventional tillage + intercultre + weedicide with three sub treatments of fertilizer applications *viz.*, 100% N through organic fertilizer, 50% N through organic fertilizer + 50% N through inorganic fertilizer and 100% N through inorganic fertilizer. From the present study it has been observed that significant increase in grain yield of wheat are observed with different combination of tillage and fertilizer. The experimental soil represented the loamy sand in texture. The pH value was 6.4, depth of the soil varies from 80 cm to 100 cm. Organic carbon percentage was 0.34 and available nitrogen, P_2O_5, and K_2O were 190, 15 and 95 kg/ha, respectively. The soils were low to very low in moisture retention. The experiment was conducted during the year 2003 to 2005. In all, there were 27 plots (3 tillage x 3 fertilizer x 3 replication) in the experiment. Conventional tillage constituted two disking and two tilling followed by planking, reduce tillage constituted one disking + one cultivator followed by planking with interculture and weeding. The experiment was conducted with split plot design. The N level of 100% organics, 50% N through organics + 50% N through inorganics and 100% N through inorganic. The manurial value of compost (N=0.5%) were computed. Weeds were controled by manual weeding as well as by using blade/rake as and when needed and by weedicide as per treatment. Crop was harvested at maturity and grain and stover yields were collected and analyzed.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Effect of resource management on grain yield :

The average of three years data (Table1) revealed that the highest grain yield of wheat of 29.33q/ha (with 26.09% variation) was recorded in T_3 (50% conventional tillage + weedicide + interculture) followed by T_1 (conventional tillage + interculture) with a grain yield of 27.87q/ha (with 27.06% variation). Mishra *et al.* (1982) reported that yield was not affected significantly with varying tillage intensities ranging from minimum to traditional tillage system. It was also reported by Saxena *et al.* (1976) that wheat yield and attributes *viz.*, ear length, grains/ear, grain weight and 1000 grain weight were significantly higher under minimum tillage than those obtained under conventional tillage.

Table 1 : Average grain yield of wheat (q/ha) in different treatments during 2002-03 to 2004-05

Treatments	Average grain yield, q/ha				SD	CV (%)
	2002-03	2003-04	2004-05	Mean		
Main treatment						
T_1 (Conventional tillage + interculture)	29.62	19.58	34.33	27.87	7.53	27.06
T_2 (50% CT + interculture)	27.12	17.90	32.43	25.82	7.35	28.47
T_3 (50% CT + weedicide + interculture)	32.53	20.60	34.87	29.33	7.65	26.09
Mean	29.75	19.36	33.88	27.66	7.48	27.04
C.D. (P=0.05)	3.46	1.97	1.75	-		
SD	2.71	1.36	1.28	1.76		
CV(%)	9.09	7.04	3.78	6.37		
Sub treatments						
F_1 (100% nitrogen through organic manure)	27.46	18.40	31.41	25.76	6.67	25.89
F_2 (50% dose of nitrogen through inorganic fertilizer + 50% N through organic manure)	30.12	19.91	34.73	28.25	7.58	26.84
F_3 (100% nitrogen through inorganic fertilizer)	31.74	19.78	35.49	29.00	8.20	28.28
Mean	29.77	19.36	33.88	27.67	7.48	27.05
C.D. (P=0.05)	3.37	1.08	0.98	-		
SD	2.16	0.84	2.17	1.69		
CV (%)	7.26	4.32	6.40	6.12		

With regard to nitrogen application through different sources, the highest average grain yield of 29.00q/ha (with 28.28% variation) was recorded with F_3 (100% nitrogen through inorganic fertilizer) followed by F_2 (50% N through organic + 50% N through inorganic fertilizers) with a grain yield of 28.25q/ha (with 26.84% variation) and the minimum grain yield of 25.76q/ha (with 25.89% variation) was recorded in F_1 (100%N through organic manures). The tillage treatment had a variation of 3.78 to 9.09 %, while fertilizer treatments has a variation of 4.32 to 7.26 % in different seasons.

Energy requirement and cost of cultivation :

The energy requirement for all three treatments *i.e.*T_1, T_2, and T_3 was 2907.53, 2281.56 and 2227.20 MJ, respectively, in production of wheat crop (Table 3). Sharma *et al*. (1984) found that the no tillage system required the minimum energy (0.56kWh/q of grain) and reduced cost of production (Rs. 2.89/qof grain) about 1.5 times higher in conventional system (0.69kWh/q of grain and Rs. 4.23/q of grain). Out of three years of experimentation, reduce tillage has significant influence on the grain yield as well as conservation of input energy. Srivastava (1982) observed that seedbed preparation and sowing together consumed nearly half of total operational energy for wheat production and also reported that a saving of 40% energy in seed bed preparation was observed under minimum tillage in comparison to optimum tillage without affecting wheat yield significantly. Marginal farmer recorded highest profit (Rs. 6631.71/ha) followed by small farmer (Rs. 4627.32/ha) and medium farmer (Rs. 3689.25) and trend clearly supports the need for mechanizing form operation for maize production (Lidhoo, 2004). The net income was higher in reduce tillage system than conventional tillage and the benefit cost ratio was also higher in reduce tillage system and ranged from 1.21: 1 to 1.08: 1

Table 2 : Grain yield of different combination of tillage and fertilizer for the year, 2002-03 to 2004-05

Year	Tillage treatments	Yield, q/ha			
		Fertilizer treatments			
		F_1	F_2	F_3	Mean
2002-03	T_1	28.54	29.87	30.68	29.69
	T_2	27.29	28.62	29.43	28.45
	T_3	29.99	31.33	32.14	31.15
	Mean	28.60	29.94	30.75	29.76
2003-04	T_1	18.99	19.87	19.86	19.57
	T_2	16.68	17.78	19.19	17.88
	T_3	19.58	22.03	20.27	20.63
	Mean	18.42	19.89	19.77	19.36
2004-05	T_1	31.61	35.22	35.91	34.25
	T_2	29.95	33.00	34.11	32.35
	T_3	32.45	35.71	36.19	34.78
	Mean	31.34	34.64	35.40	33.79

Table 3 : Operational energy and cost of cultivation involved in different treatments.

Sr. No.	Operations	Energy in MJ/ha		
		T_1	T_2	T_3
1.	Tillage	1790.45	1020.81	1100.50
2.	Layout and sowing	500.45	499.80	528.37
3.	Weedicide application	-	-	50.67
4.	Hoeing/inter-culture	186.85	300.45	98.88
5.	Harvesting	180.38	230.50	200.98
6.	Threshing & cleaning	249.40	230.00	247.80
7.	Total energy input, MJ/ha	2907.53	2281.56	2227.2
8.	Cost of cultivation, Rs/ha	11347.33	9948.67	10335.30
9.	Output, Rs/ha	23689.50	21947.00	24930.50
10.	Net income, Rs/ha	12342.17	11998.30	14595.20
11.	Benefit cost ratio	1.08	1.21	1.41

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REFERENCES

Lidhoo, C.K. (2004). Pattern of energy use in dryland maize. *J. Res., Sher-e- Kashmir Univ. Agric. Sci. & Technol. Jammu*, **3** (2) : 228-236.

Mishra, S.S., Munar, A. and Mishra, S (1982). Tillage fertility and weed management system in rotation to wheat production (c.f. Weed Abstract, **33**(9): 2771.

Nambiar, K.K.M. and Abrol, I.P. (1989). Long term fertilizer experiment in India: An overview. *Fertilizer News*, **34**(4) : 11-20.

Nielsen (1990). Direct drilling and reduce tillage. Seminar No. 165 between researchers and producers of soil cultivation implements. Cultivation methods and implement design, sandivika,Norwey, 22-23 Nov.1989 (c.f. *Agril.Engg.Abstract* 1991 No.1978).

Pathak, S.K., Singh, S.B. and Singh, S.N. (2002). Effect of integrated nutrient management on growth, yield and economics in maize (Zea Mays), wheat (*Triticum aestivum*) cropping system. *Indian J. Agron.*, **47**(3): 325-332.

Saxena, R.K., Singh, B.P. and Singh, P.N. (1976). Response of wheat to minimum tillage. *Indian J. Agron.*, **21**(2): 165-166.

Sharma, D.N. *et al.* (1984). Evaluation of no tillage and conventional tillage system. *Agric. Mech. Asia Afr. Latin Am. (AMA)*, **15**(3): 14-18.

Singh, J.P., Abrol, Vikas and Hussain, S.Z. (2009). Impact of tillage and nutrrient management in maize –wheat crop rotation under dryland cultivation. *Agric. Mech. Asia Afr. Latin Am. (AMA)*, **40**(1): 60-64.

Srivastava, A.C. (1982). A comparative study of conventional and mechanical farming relative to energy use and cost. *AMA*, **13** (2) : 42-46.

Wani, S.P., Mc.Gill, W.B., Haugun-Kozyra, K.L., Robertson, J.A. and Thruston, J.J. (1994). Improved soil quality and barley yield with faba beans, manures..Storage and crop rotations on a gray Luvisol. *Can. J. Soil Sci.*, **74** (1) : 75-84.