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CONSERVATION OF DIFFERENT RESOURCES THROUGH TILLAGE AND SOWING MANAGEMENT IN RICE-WHEAT CROPPING SYSTEM

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ABSTRACT

A field study was carried out at Soil Conservation and Water Management Farm of C.S. Azad University of Agriculture and Technology, Kanpur during two consecutive years from 2010-12 to assess the effect of different tillage operations and sowing management techniques in rice-wheat cropping systems. Rice crop was grown with four treatments viz. P_1-Direct sowing of rice (DSR), P_2 - Direct sowing of rice with brown manuring of dhaincha (DSR+BM), P_3-Transplanting of rice without puddling (TPR) and P_4-Transplanting of rice after green manuring of dhaincha (TPR+GM) while three treatment were applied in wheat i.e. W_1-Direct sowing of wheat (DSW), W_2-Conventional till sowing of wheat (CTW) and W_3-Bed planting of wheat (BPW). The experiment was laid out in randomized block design with three replications. Experimental soil was sandy loam slightly alkaline in nature and of medium fertility status. A uniform dose of 120 kg N_2 + 60 Kg P_2O_5 + 40 kg K_2O/ha was applied to all treatments. Two years pooled data revealed that the transplanting of rice after green manuring of daincha attained highest values of plant stand (440.43), plant height (85.96 cm), number off shoots (440.43 per m^2), number of panicle (323.81), spike length (29.01 cm), number of grains/ panicle (97.69), test weight (22.36), grain yield (47.67 q/ha), straw yield (76.14 q/ha) and net return (Rs. 66406/ ha) with 2.18 B:C ratio followed by transplanting of rice without puddling. In wheat crop, highest plant height (90.30 cm) number of spikes (361.88), spike length (16.33 cm), number of grains/ear (42.13), test weight (45.40), grain yield (46.53 q/ha), straw yield (74.43 q/ha) and net return (Rs. 62889/ha) with 2.07 B:C ratio was obtained.

Key words : *Resource conservation, rice-wheat planting system*,

Among food grains, rice and wheat are most importance which cultivated under different cropping sequences. According to recent statistic of India, rice is grown on an area of 39.47 million hectares with production of 87.10 million tonnes annually and average productivity of 2207 kg/ha and wheat is grown on an area of 29.25 million hectare with production of 85.93 million tonnes annually and average productivity of 2938 kg/ha (1). The present level of average productivity of rice and wheat in state and country is much lower not only than European and American countries but even than China. It emphasizes the scope and need of increase in average productivity of rice and wheat in the country.

Rice and wheat are two major food grain crops which contribute more than 70 percentage of total food grain production in the country. The area, production and productivity of these two crops have increased dramatically during the last 30 years. Considering all above facts and need of increasing rice and wheat production, the present study entitled "Conservation of different resource through tillage and sowing management in Rice-Wheat cropping system" were undertaken during kharif and rabi, 2010-12 in the Department of Soil Conservation and Water Management, C.S. Azad University of Agriculture & Technology, Kanpur with the objectives to assess the effect of planting systems and tillage management of rice on growth, yield attributes ,yield and economics of rice and wheat and compare the different planting system of rice and wheat in term of growth, yield attributes and yield.

MATEIALS AND METHODS

The field experiment was carried out during kharif and rabi, 2010-2012 at Department of Soil Conservation and Water Management, C.S. Azad University of Agriculture and Technology, Kanpur. The farm is situated at the main campus of university which lies at latitude of 26028' north and longitude of 80021'. The experimental field having sandy loam soil texture with 0.31% OC, 15.6 kg/ha P_2O_5, 151.4 kg/ha available K_2O. The soil pH was 7.6 and electrical conductivity was 0.35 dS/m at 25^0C. Rice crop (var. NDR 97) was grown with

Table-1 : Effect of treatments on growth characters of rice.

Treatments	Plant height (cm)	No. of shoots/m^{-2}	No. of panicles/m^{-2}	Panicle length (cm)	No. of grains/ panicle	Test weight (g)
P_1	81.37	403.78	302.69	24.69	89.28	21.25
P_2	83.17	416.94	310.60	25.87	91.74	21.72
P_3	84.74	425.67	315.34	26.79	94.17	22.01
P_4	85.96	440.43	323.81	29.01	97.69	22.36
S.E.±	0.28	3.33	1.62	0.32	0.64	0.06

four treatments viz. P_1 - Direct sowing of rice (DSR), P_2 - Direct sowing of rice with brown manuring of dhaincha (DSR+BM), P_3-Transplanting of rice without puddling (TPR) and P_4-Transplanting of rice after green manuring of dhaincha (TPR + GM) while three treatment were applied in wheat (var, Shatabdi) i.e. W_1-Direct sowing of wheat (DSW), W_2-Conventional till sowing of wheat (CTW) and W_3-Bed planting of wheat (BPW). The experiment was laid out in randomized block design with three replications. Experimental soil was sandy loam slightly alkaline in nature and of medium fertility status. A uniform dose of 120 kg N_2 + 60 Kg P_2O_5 + 40 kg K_2O/ha was applied to all treatments.

RESULTS AND DISCUSSION

RICE

Growth Characters : The treatment P_4 of transplanting of rice after G.M. was observed significantly highest plant height and number of shoots per m^2 followed by treatment P_3 and P_2, while it was lowest in treatment P_1 of direct seeding because green manuring of dhaincha improved physical condition of soil, provide maximum nutrient availability for nurshing the crop and less completion to weeds as compared to other treatment (2) also confirm these results.

The yield attributes of rice viz. number of panicles per m^2, number of grains per panicle, panicle length and test weight were influenced by methods of sowings and increase in order of direct sowing of rice, direct sowing rice with brown manurring of dhaincha, transplanting without puddling and maximum in treatment P_4 of transplanting of rice after green manuring of dhaincha. The enhancement in yield attributes under treatment P_4 were perhaps due to benefits of transplanting along with addition of organic matter in the soil through incorporation of G.M. of dhaincha that improve the physical properties and make a way of higher nutrient availability to nurture the crop and less competition of height, nutrient and water due to less weed infestation in comparison to direct seeded rice, direct seeded rice with brown manuring.

The different sowing methods were also affecting to the panicle length and grains per panicle. More number of grains per panicle were recorded in the treatment of transplants of rice after G.M. of dhaincha followed by transplanting without puddling, direct seeded rice with brown manuring and lowest in direct seeded rice. The harvest index was worked out highest in transplanting after green manuring and lowest in direct seeded rice. The results were conformity of (2).

Yield : Grain and straw yield of rice increased significantly with the method of sowing in order of direct sowing, direct sowing with brown manuring, transplanting without puddling and found highest in treatment P_4 of transplanting after G.M. may be due to beneficial effect of transplanting associated with green manuring. All growth characters along with yield parameters were found viable and effective in encouraging yield in the treatment of transplanting of rice after G.M. These results are in encouraging yield at transplanting of rice after G.M. These results are in line with the findings of (3).

Economics : The cost of cultivation, gross return and net return rose with the methods of sowing in sequence P_1 of direct sowing treatment of rice, P_2 of direct sowing

Table-2 : Effect of treatments on grain and straw yield (q/ha) of rice.

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
P_1	33.33	52.32	85.65	38.91
P_2	37.43	59.88	97.31	38.46
P_3	41.80	66.95	108.75	38.43
P_4	47.67	76.14	123.81	38.50
S.E.±	0.28	2.65	5.15	0.50
C.D. (P=0.05)	0.97	9.16	17.80	NS

Table-3: Effect of different tillage and sowing management practices on economics of rice-wheat system.

Treat-ments	Cost of Cultivation (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B:C ratio
P_1	56233	112150	51522	1.99
P_2	57933	117896	55572	2.03
P_3	59633	123900	59870	2.07
Ps	59933	131929	66406	2.18

with brown manuring, P_3 transplanting without puddling and P_4 transplanting after G.M. Though the cost of cultivation was increase with the methods of sowing but the rate of increase in grain yield was comparatively. Much higher under treatment transplanting after G.M which ultimately resulted in higher gross return and net return. The results were in conformity with (2).

WHEAT

Growth Characters : Bed planting treatment proved superior to other methods of sowing in improving plant growth characters of wheat viz. plant stand, plant height, number of shoots. Superiority of bed planting over other methods of sowing was probably due to better root growth due to more aeration, less competition for height and nutrients, more efficient use of conserved water in furrows. On other hand, conventional till sowing and direct sowing were inferior to bed planting method in respect of plant growth characters of wheat viz. plant height and number shoots per m^2 area. The results are in conformity of (4).

Yield Attributes : Bed planting treatment increase yield attributing characters viz. number of ears/plant, ears length, numbers of grains/ear as well as grain weight and grains/ears as well as 1000 grain weight and grain as well as straw yield significantly over conventional till sowing and direct sowing methods perhaps due to aeration for proper root growth and maximum nutrient absorption and its transfer from source to sink that contribute to all attributes and effectively yield of wheat.

The direct sowing method registered minimum values of ears/plant, ears length and numbers of grains per ears as well as 1000 grain weight and grain yield as well as straw yield. The weight was recorded highest with bed planting which reduced to conventional till sowing and minimum to direct sowing method. Similar results were observed by (5).

Yield : Among different treatments wheat grain yield of

Table-4: Effect of rice and wheat treatments on number of plant height (cm) and shoots per m^2 of wheat at successive crop stages.

Treatments	Plant height (cm) at 120 DAS	No. of shoots per m^2 at 120 DAS
Wheat followed by Rice planting system		
P_1	87.69	377.60
P_2	85.32	380.87
P_3	90.20	384.33
P_4	90.87	387.51
S.E.±	0.94	3.92
C.D. (P=0.05)	2.76	NS
Sowing method of Wheat		
W_1	88.61	375.47
W_2	90.30	380.76
W_3	0.82	391.52
S.E.±	2.40	3.40
C.D. (P=0.05)	2.40	9.97

wheat bed planting produced significantly highest grain yield of 46.53 q/ha, which was found 9.65 q/ha or 20.74% and 4.98 q/ha or 10.70% higher than the grain yields recorded under treatments of direct sowing (W_1) and conventional till-sowing (W_2), respectively. In other words, direct sowing of wheat caused significant grain yield reduction i.e. 20.74% as compared to bed planting. However, bed planting of wheat proved as the best method of wheat sowing to get higher grain yield.

In case of straw yield of wheat treatments, bed planting produced highest of 74.43 q/ha straw, which was found 17.45 and 23.44% higher than direct sowing and conventional till-sowing, respectively with significant variation between all treatments.

Table-5 : Effect of rice and wheat treatments on yield attributes of wheat.

Treatments	No. of spikes m^{-2}	Spike length (cm)	No. of grains/ spike	Test weight (g)
Wheat followed by rice planting system				
P_1	343.41	14.53	38.47	44.20
P_2	347.62	15.03	39.37	44.22
P_3	353.43	15.40	40.60	44.31
P_4	356.37	15.80	41.00	44.82
S.E.±	5.88	0.22	0.57	0.50
C.D. (P=0.05)	NS	0.64	1.66	NS
Sowing method of Wheat				
W_1	341.83	14.25	37.80	43.65
W_2	346.92	15.00	39.65	44.12
W_3	361.88	16.33	42.13	45.40
S.E.±	5.09	0.19	0.49	0.43
C.D. (P=0.05)	14.92	0.55	1.44	1.27

Table-6 : Effect of rice and wheat treatments on grain and straw yields (q/ha) of wheat.

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)	Harvest index (%)
Wheat followed by Rice planting system				
P_1	36.47	56.93	93.40	39.12
P_2	41.43	64.47	105.90	38.97
P_3	42.03	66.32	108.35	38.79
P_4	46.00	73.62	119.62	38.45
S.E.±	0.61	1.07	1.37	0.17
C.D. (P=0.05)	1.79	3.15	4.02	NS
Sowing method of Wheat				
W_1	36.88	57.48	94.36	39.08
W_2	41.55	65.35	106.90	38.86
W_3	46.53	74.43	120.96	38.46
2S.E.±	0.53	0.93	1.19	0.14
C.D. (P=0.05)	1.55	2.72	3.49	NS

Table-7 : Effect of different tillage and sowing management practices on economics of rice-wheat system.

Treat-ments	Cost of Cultivation (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B:C ratio
W_1	42775	87690	37115	1.53
W_2	56300	1138135	47213	2.02
W_3	58200	121389	62889	2.07

Economics : The cost of cultivation, gross return and net return rose with the methods of sowing in sequence W_1 of direct sowing treatment of wheat, W_2 of conventional till sowing, W_3 of wheat sowing on furrow irrigated raised bed technique. Though the cost of cultivation was increase with the methods of sowing but the rate of increase in grain yield was comparatively much higher under wheat sowing furrow irrigated raised bed which ultimately resulted in higher gross return and net return. Similar economic pattern was followed by (6).

CONCLUSION

Among different method of sowing and tillage management, transplanting of rice after green manuring of dhaincha in rice treatments and bed planting in wheat treatments obtain highest of 47.67 q and 46.53q q/ha grains yield, respectively.

Gross return, net return and B : C ratio were computed highest in transplanting of rice after green manuring of daincha and bed planting of wheat which reduce significantly in order of transplanting without puddling, direct seeded rice with brown manuring of dhaincha and lowest under direct seeded rice along with conventional till weight sowing and direct sowing of wheat.

On the basis of this study it can be strongly recommended for farmers to grow rice after green manuring of dhaincha in kharif followed by wheat on furrow irrigated raised bed in rabi to minimize the hazardous affect of rice-wheat systems as well as improve the physico-chemical conditions of soil by enriching the organic matter they can save the water, nutrients, labour, energy and other resources.

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