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On-farm evaluation of management practices of rice and wheat in sub-montane low hills of Himachal Pradesh

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Abstract

An on-farm experiment was conducted in sub-montane low hills sub-tropical zone of Himachal Pradesh to study the impact of application of recommended dose of nutrients and full package of practice as against farmers' practice in rice-wheat cropping sequence under irrigated conditions. The treatments were evaluated at fourteen locations for the two consecutive cropping seasons of 2001-02 and 2002-03. Results of the study revealed that single intervention of applying recommended fertilizer nutrients over the existing farmer's practice increased the overall grain and straw yield of rice and wheat by about 33 and 40 per cent, respectively. The application of full recommended package of practices further increased rice and wheat yields by about 16 and 17 per cent, respectively. The recommended package of practices increased rice grain equivalent yield, net return and B: C ratio by about 57, 74 and 29 per cent over the farmer's practice and 17, 22 and 14 per cent, respectively over the recommended application of nutrients.

Key words: Rice-wheat cropping sequence, nutrients, full package.

Introduction

Rice-wheat is the most prevalent cropping system in India and it contributes about 25 per cent of the National food production (Ladha *et al.* 2000). In Himachal Pradesh, this system covers more than 80 thousand hectares with average productivity of 3.07 t/ha (Anonymous 2002) as against the National average of 5.7 t/ha (Anonymous 2003). This system has sustained over years but now the productivity of both the crops has stagnated and factor productivity is declining year after year because there is great difference in actual and achievable yield. This is due to the use of low yielding traditional varieties, imbalance and inadequate use of nutrients, sub-optimal plant stand and heavy weed infestation particularly in rice, use of inadequate irrigation and improper plant protection measures. Apart from this, lack of knowledge about the non-monetary inputs is the major constraint which influences the productivity level. As the system is very exhaustive, there is greater drain on the native soil fertility emphasizing balanced application of nutrients to sustain the productivity. The cultivation of improved varieties, timely and proper control of weeds, insect pests and diseases are essential for sustaining the yields. It is therefore, necessary to investigate the effect of proper nutrient management and recommended package for rice-wheat system on the farmers' fields. Keeping in view these considerations, present study was undertaken on the farmers' fields to investigate appropriate production technology for increasing productivity of rice and wheat.

Material and Methods

Field experiments on cultivators' fields were conducted for two years (2001-02 and 2002-03) at Surajpur, Battamandi, Nihalgarh and Kolar centres of district Sirmour (Farming situation I) and Rajpura and Manpura centres of district Solan (Farming situation II) within NARP Zone I of Himachal Pradesh. Fourteen locations; two at each centre in district Sirmour and three at each centre in district Solan, were selected. The soils of the experimental locations were inceptisols having soil texture loamy sand to silty clay loam with pH slightly acidic to neutral, medium to high in organic carbon, available N and P and medium in available K contents. The total rainfall received was 1591.6 mm and 1288.5 mm during 2001-02 and 2002-03, respectively with maximum and minimum temperatures ranging from 19.3-38.2 °C and 3.0-23.1 °C, respectively. Rice variety Kasturi Basmati and wheat variety PBW-343 were sown during both the years. The treatments were: farmers practice (application of FYM @ 5t/ha, N @ 40% of recommended dose of N. No criteria of seedling age/seed rate, method of sowing, plant protection measures and inappropriate weed control measures without considering critical

and 40 kg K_2O/ha in rice, 120 kg N, 60 kg P30 in wheat and other practices as in farmers' practice) and full recommended package of practices (100% NPK, transplanting/seeding at proper stage with proper method and spacing, irrigation at proper stage, herbicidal weed control & proper plant protection measures). One trial was laid out at each location. Yields were harvested from net plot (80.04 to 89.1 m^2). Economics of the treatments was computed based upon prevalent prices. The statistical analysis of the data was performed in randomized block design considering locations as replications.

Results and Discussion

Crop yields

The data (Table 1) revealed that application of recommended fertilizer nutrients resulted in significantly higher grain and straw yields of rice and wheat in both the farming situations. Single intervention of applying recommended fertilizer nutrients in the existing farmer's practice increased the overall grain and straw yield of rice and wheat by about 33 and 40 per cent, respectively.

The increase in rice and wheat grain yield was higher in Sirmour (35 and 45 %) than in farming situation 'Solan' (30 and 33 %, respectively). Yields further increased by adopting the full package of practices. The application of full recommended package of practices further increased rice and wheat yields by about 16 and 17 per cent, respectively. Such a response to applied nutrients and improved cultivation practices can be expected in the farmers' fields. Balanced application of nutrients and improved cultivation practices have been reported to be essential for sustained productivity (Prasad *et al.* 2002, Rinwa *et al.* 2003).

Rice grain equivalent yield

Owing to increased rice and wheat yields, the system productivity as expressed in terms of rice equivalent yield, was significantly higher in recommended application of nutrients over the farmers' practice in each farming situation (Table 2). Rice grain equivalent yield further increased with the adoption of full package of practices. The recommended package of practices increased rice grain equivalent yield by about 60 and 53 per cent over the farmer's practice and about 15 and 18 per cent over recommended application of nutrients in the farming situation I and II, respectively.

Table 1. Effect of different treatments on yields of rice and wheat in rice-wheat cropping sequence

Treatments	Rice						Wheat					
	Grain			Straw			Grain			Straw		
	2001-02	2002-03	Mean	2001-02	2002-03	Mean	2001-02	2002-03	Mean	2001-02	2002-03	Mean
	Sirmaur (Mean of 8 locations)											
Farmers' practice	2579	2762	2671	3461	3571	3516	2516	2773	2645	2769	3058	2913
Recommended nutrients	3497	3701	3599	4658	4738	4698	3665	3984	3824	3811	4431	4121
Recommended package	4171	4114	4142	5549	5645	5597	4253	4549	4401	4678	5062	4870
LSD (P=0.05)	283	275	259	291	397	302	214	223	208	335	252	225
	Solan (Mean of 6 locations)											
Farmers' practice	2412	2115	2264	3016	2477	2747	2474	2505	2490	2721	2690	2706
Recommended nutrients	3044	2850	2947	3804	3432	3618	3320	3284	3302	3650	3836	3743
Recommended package	3701	3259	3480	4626	4025	4325	3888	3948	3918	4275	4617	4446
LSD (P=0.05)	102	258	159	128	366	218	146	158	139	163	162	101
	Overall (Mean of 14 locations)											
Farmers' practice	2508	2485	2496	3270	3102	3186	2498	2658	2578	2748	2900	2824
Recommended nutrients	3303	3336	3319	4292	4178	4235	3517	3684	3600	3742	4176	3959
Recommended package	3970	3747	3858	5153	4951	5052	4096	4291	4194	4505	4871	4688
LSD (P=0.05)	169	181	161	192	273	207	145	160	146	202	154	134

Table 2. Effect of different treatments on rice grain equivalent yield and economics in rice-wheat cropping sequence

Treatments	Rice grain equivalent (kg/ha)			Returns (Rs./ha)		B:C ratio
	2001-02	2002-03	Mean	Gross	Net	
			Sirmaur (Mean of 8 locations)			
Farmers' practice	4736	5139	4938	43177	27640	1.78
Recommended nutrients	6638	7115	6877	60045	40369	2.05
Recommended package	7816	8012	7914	69519	48457	2.30
LSD (P=0.05)	367	399	363	2970	2970	0.14
			Solan (Mean of 6 locations)			
Farmers' practice	4532	4262	4397	38264	22727	1.46
Recommended nutrients	5890	5664	5777	50608	30932	1.57
Recommended package	7034	6643	6838	59974	38912	1.85
LSD (P=0.05)	138	206	107	979	979	0.06
			Overall (Mean of 14 locations)			
Farmers' practice	4649	4763	4706	41071	25534	1.64
Recommended nutrients	6317	6493	6405	56001	36325	1.85
Recommended package	7481	7426	7453	65428	44366	2.11
LSD (P=0.05)	240	258	234	1934	1934	0.08

Net return

The higher yields following the application of recommended fertilizers in farmers' practice and full recommended package of practices fetched increased gross and net return in both the farming situations. On an average, the application of recommended nutrients recorded 42 per cent higher net return over farmers' practice. Application of full recommended package of practices recorded 74 and 22 per cent higher net return over farmers' practice and recommended application of nutrients, respectively.

B: C ratio

B: C ratio was significantly highest owing to recommended package of practices. Application of recommended package of practices resulted in 29 and 14 per cent higher B: C ratio over farmers' practice and recommended nutrients application, respectively.

The findings of the present investigation conclusively inferred that for feeding the growing population, farmers should go for recommended package of practices in rice-wheat cropping system without any compromise. Resource poor and marginal farmers who can not afford to apply the full package, they should at least apply the recommended dose of nutrients to sustain yields and fetch higher returns.

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