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Effect of Organic Manures and Chemical Fertilizers on Wheat (*Triticum aestivum* L.) and Their Residual Effect on Green Gram (*Phaseolus radiatus* L.)

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ABSTRACT

In a field experiment conducted during 1992-93 and 1993-94 on clayey soil at Junagadh, the direct effect of organic manures (FYM and castor cake) and chemical fertilizers, alone and combined, on wheat (*Triticum aestivum* L. emend. Fiori & Paol.) and their residual effect on green gram (*Phaseolus radiatus* L.) were studied. Combined application of castor cake @ 5 t/ha or FYM @ 15 t/ha alongwith recommended NP dose to wheat recorded significantly higher grain and straw yield of wheat. Higher grain and fodder yield of green gram were recorded due to residual effect of 15 t FYM + 120 kg N + 60 kg P_2O_5/ha applied to preceding wheat crop. Application of 15 t FYM + 120 kg N + 60 kg P_2O_5/ha to wheat also recorded higher net return and B : C ratio from wheat and green gram and thereby from wheat green gram crop sequence.

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INTRODUCTION

Addition of organic manures increase crop yield and exert significant influence on physical, chemical and biological properties of soil (Acharya *et al.*, 1987 and Bahadur *et al.*, 1990). But its use alone is not sufficient to meet the nutrient requirement of crop. Therefore, use of both organic manures and chemical fertilizers in appropriate proportion assume special significance as complementary and supplementary to each other in crop production. Due to slow release of nutrients and longer lasting effects of organics, succeeding crops have some benefit. In view of this, an experiment was undertaken to study the direct effect of organic manures and chemical fertilizers, alone and combined with each other, on wheat (*Triticum aestivum* L. emend. Fiori & Paol.) and their residual effect on succeeding green gram crop (*Phaseolus radiatus* L.).

MATERIALS AND METHODS

The field experiment was conducted on a clayey soil (pH 8.1, E.C. 0.32 dS/m, available N 214 kg/ha, available P_2O_5 34 kg/ha and available K_2O 303 kg/ha) during 1992-93 and 1993-94 at the Instructional Farm, College of Agriculture, Junagadh. Experiment was laid out in randomised block design with 4

TABLE 1
Effect of different treatments on grain and straw yields of wheat and their residual effect on grain and fodder yield of green gram.

Treatments	Wheat						Green gram					
	Grain yield (q/ha)			Straw yield (q/ha)			Grain yield (q/ha)			Fodder yield (q/ha)		
	92-93	93-94	Pooled	92-93	93-94	Pooled	92-93	93-94	Pooled	92-93	93-94	Pooled
T_1 FYM	35.42	35.93	35.68	48.98	47.36	48.17	7.16	8.93	8.05	25.76	28.63	27.20
T_2 CC	46.91	41.40	44.16	59.96	48.13	54.05	5.55	6.89	6.22	24.81	27.41	26.11
T_3 FRD	46.37	39.63	43.00	58.18	47.51	52.85	4.44	5.12	4.78	22.82	24.29	23.56
T_4 HRD	36.65	27.29	41.97	51.46	36.25	43.86	2.95	5.03	3.99	21.86	23.77	22.81
T_5 Eq. NPK of FYM	44.96	34.94	39.95	57.10	47.21	52.15	4.58	6.04	5.31	24.29	25.16	24.72
T_6 Eq. NPK of CC	47.07	41.50	44.29	60.73	53.73	57.13	5.03	6.77	5.90	24.64	26.72	25.68
T_7 FYM + FRD	47.23	46.42	46.83	61.40	56.77	59.09	8.30	9.91	9.11	26.20	33.83	30.01
T_8 FYM + HRD	39.74	39.80	39.77	53.36	50.29	51.83	7.51	9.56	8.54	26.02	33.66	29.84
T_9 CC + FRD	51.70	49.06	50.38	66.54	64.33	65.44	5.81	7.48	6.65	25.33	28.11	26.72
T_{10} CC + HRD	49.39	47.74	48.57	64.88	63.87	64.38	5.73	7.15	6.44	24.98	27.76	26.37
T_{11} Control	19.89	18.73	19.31	28.56	27.62	28.09	2.91	3.64	3.28	20.82	19.09	19.95
T_{12} FRD to G. gram	20.40	17.51	18.96	30.35	25.46	27.91	7.10	8.57	7.84	25.68	28.45	27.07
C. D. at 5%	4.39	6.73	5.62	5.10	8.21	7.46	1.21	1.56	1.32	2.12	7.82	4.04

replications and 11 treatments viz., T_1 – farmyard manure (FYM) @ 15 t/ha, T_2 – castor cake (CC) @ 5 t/ha, T_3 – full recommended NP dose (FRD) i.e. 120 kg N + 60 kg P_2O_5/ha, T_4 – half recommended NP dose (HRD) i.e. 60 kg N + 30 kg P_2O_5/ha, T_5 – equivalent NPK of FYM i.e. 111 kg N + 66 kg P_2O_5 + 98 kg K_2O/ha, T_6 – equivalent NPK of castor cake i./e. 186 kg N + 66 kg P_2O_5 + 59 kg K_2O/ha, T_7 – FYM @ 15 t/ha + full recommended NP dose, T_8 – FYM @ 15 t/ha + half recommended NP dose, T_9 – castor cake @ 5 t/ha + full recommended NP dose, T_{10} – castor cake @ 5 t/ha + half recommended NP dose, and T_{11} – control (no manures and no fertilizers) for wheat crop and additional treatment T_{12} – recommended NP dose i.e. 20 kg N + 40 kg P_2O_5/ha to green gram (no manures and no fertilizers to wheat). Wherat variety GW-496 (96-113 days duration) was sown in rows of 22.5 cm apart during *rabi* seasons and green gram variety K-851 (65-70 days duration) was sown in rows of 30 cm spacing during succeeding summer seasons. Treatment-wise FYM (0.74% N, 0.44% P_2O_5 and 0.65% K_2O) and castor cake (3.71% N, 1.32% P_2O_5 and 1.18% K_2O) were applied before sowing, whereas half N and full P and K in form of urea, single super phosphate and muriate of potash, respectively were applied as basal and remaining half N was top-dressed in form of urea at 30 days after sowing. In case of treatment T_{12}, entire NP dose as urea and single super phosphate was applied as basal to green gram crop only. Wheat was sown on November 13, 1992 and November 18, 1993 and harvested on February 20, 1993 and March 1, 1994, while green gram was sown on February 25, 1993 and March 6, 1994 and harvested on May 8, 1993 and May 14, 1994. Total 10 irrigations to wheat and 8 irrigations to green gram were given as per recommended schedule.

RESULTS AND DISCUSSION

Different manurial treatments exert significant influence on grain and straw yields of wheat during both the years and in pooled results (Table 1). Higher yields were recorded with application of castor cake @ 5 t/ha + full recommended NP dose (T_9) which was at par with castor cake @ 5 t/ha + half recommended NP dose (T_{10}) during 1992-93 and also with FYM @ 15 t/ha + full recommended NP dose (T_7) during 1993-94 and in pooled results. The results are in accordance with those of Tripathi (1982) and Patel *et al.* (1992). On an average, these three treatments increased 13 and 152% grain yields as well as 19 and 124% straw yield of wheat over full recommended NP dose and control, respectively.

Various treatments showed a significant residual effect on grain and fodder yield of green gram (Table 1). Significantly the higher grain yield of green gram was recorded due to FYM @ 15 t/ha + 120 kg N + 60 kg P_2O_5/ha (T_7) which was at par with FYM @ 15 t/ha (T_1). However the latter was at par with 20 kg N + 40 kg P_2O_5/ha (T_{12}) during both the years and in pooled results. Similarly, application of FYM @ 15 t/ha + full recommended NP dose to wheat (T_7) recorded significantly higher fodder yield of green gram over recommended NP dose (T_3), half recommended NP dose (T_4) and control (T_{11}). The results corroborate the findings of Rao and Bhardwaj (1980) and Sharma (1981). Application of FYM @ 15 t/ha + 120 kg N + 60 kg P_2O_5/ha to wheat residually increased 16 and 177% grain yield as well as 11 and 50% fodder yield of green gram over recommended NP dose to green gram (T_{12}) and control (T_{11}), respectively.

TABLE 2
Effect of different treatments on monetary returns from wheat and green gram.

Treatments	Mean net return (Rs/ha)			mean cost (Rs/ha)			Mean B:C ratio		
	Wheat	G.gram	Combined	Wheat	G.gram	Combined	Wheat	G.gram	Com-bined
T_1 FYM	12817	6139	18956	7773	4139	11912	1.65	1.48	1.59
T_2 CC	8878	3857	12735	16418	4139	20557	0.54	0.93	0.62
T_3 FRD	17564	2035	19449	7158	4139	11297	2.45	0.49	1.72
T_4 HRD	11625	1072	12697	6718	4139	10857	1.73	0.26	1.17
T_5 Eq. NPK of FYM	15291	2717	18008	7580	4139	11719	2.01	0.66	1.54
T_6 Eq. NPK of CC	17499	3463	21212	7829	4139	11968	2.24	0.84	1.77
T_7 FYM + FRD	18122	7479	25601	8803	4139	12942	2.06	1.81	1.94
T_8 FYM + HRD	14597	6778	21375	8313	4139	12452	1.76	1.64	1.72
T_9 CC + FRD	11536	4396	15933	17448	4139	21587	0.66	1.06	0.74
T_{10} CC + HRD	11019	4134	15153	16958	4139	21097	0.65	0.99	0.72
T_{11} Control	4989	133	5122	6178	4139	10317	0.81	0.03	0.50
T_{12} FRD to G.gram	4768	5375	10143	6178	4635	10813	0.77	1.16	0.98

Application of FYM @ 15 t + 120 kg N + 60 kg P_2O_5/ha (T_7) recorded the maximum net return from wheat, green gram and crop sequence (Table 2). Fertilizing wheat crop with full recommended NP dose resulted in the maximum B:C ratio in wheat, while application of FYM @ 15 t/ha + full recommended NP dose to wheat recorded the maximum B:C ratio in green gram and crop sequence.

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