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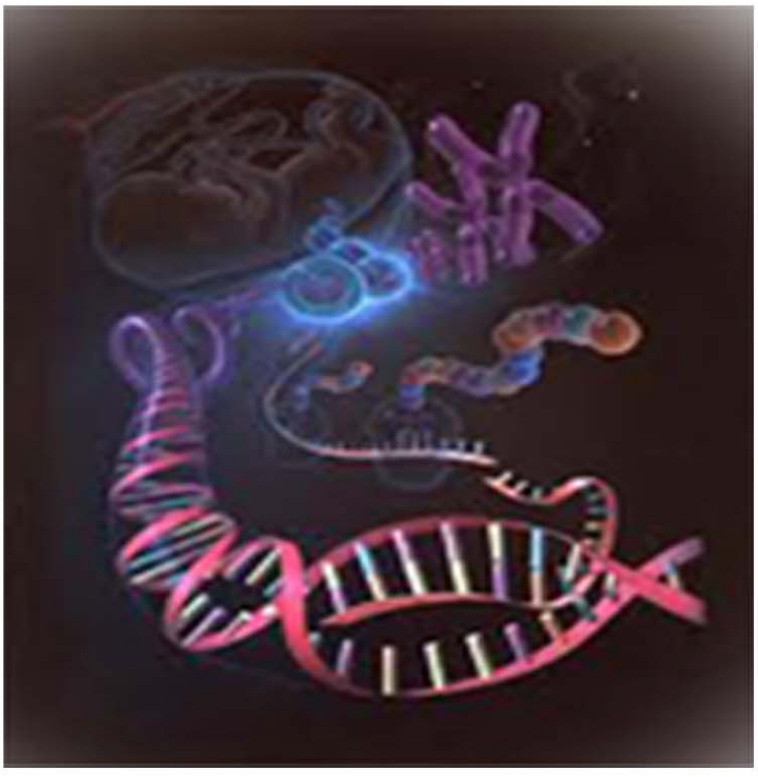

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Research Paper

EFFECT OF DIFFERENT SOURCES OF NUTRITION AND IRRIGATION LEVELS ON YIELD, NUTRIENT UPTAKE AND NUTRIENT USE EFFICIENCY OF WHEAT

Parvinder Kumar[1*] and R K Pannu[1]

Corresponding Author: **Parvinder Kumar, ✉ balyanpk@yahoo.com*

A field experiment was conducted at CCS Haryana Agriculture University, Hisar Haryana during 2005-06 and 2006-07 to study the effect of organic sources of nutrition and irrigation levels on yield, nutrient uptake and nutrient use efficiency of wheat.The grain yield increased by 19.4 and 22.6 % in I_2 over I_1 and 12.5 and 14.2 % over I_2 in I_3 (3868 and 4060 kg/ha) during 2005-06 and 2006-07, respectively. The increase in irrigation frequency increased the N (18.8 and 23.6 %), P (19.7 and 23.4 %) and K (17.4 and 16.8 %) uptake over I_1 and N (6.0 and 6.7 %), P (5.5 and 6.9 %) and K (5.8 and 4.9 %) uptake over I_2 in I_3 treatment during two years of study, respectively. The apparent recovery of N also increased by 28.8 and 32.2 % over I_1 and 6.5, 16.8 % over I_2 in I_3 treatment during both the year of experimentation, respectively. The increase in dose of organic manure from 75 to 150 and 225 kg N/ha by any sources increased the grain yield of wheat significantly increased during both the year. The increase in level of poultry manure increased the N, P and K uptake from T_9 (80.5, 83.2, 18.9, 19.5, 81.0 and 81.7 kg/ha) and form T_{10} (93.2, 96.6, 21.6, 22.6, 89.0 and 90.4 kg/ha) in T_{11} treatment during both the years of study, respectively.

Keywords: Sources of nutrition, Irrigation, Nutrient uptake, Nutrient use efficiency

INTRODUCTION

Wheat is a predominant winter (rabi) crop of northwestern plain zone and central zone of India. During the past three decades, intensive agriculture involving exhaustive high yielding varieties has led to heavy withdrawal of nutrients from the soil. The productivity of a crop is controlled by many factors of which the mineral nutrition especially of nitrogen is by and large. The most important factor is that the heavy and imbalanced use of chemical fertilizer has led to think about the use of organic manures in intensively growing areas for sustainable production system. Therefore, to sustain the land and to achieve production potential of crops, judicious use of organic manures and their scientific management is important. It must be stressed that the value of FYM, vermicompost,

[1] Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana.

poultry manure and green leaf manure in soil improvement is due to there nutrient content, besides helping in the improvement of soil structure and water holding capacity of soil (Kale and Bano, 1986 and Srivastava, 1998). For organic crop production, the seeds produced under organic system has to be used. In view of this the present investigation was carried out to know the effect of organic manures on seed yield and quality of wheat.

Wheat is highly responsive to irrigation application. The potential yield of wheat can only be harvested by timely and judicious use of water. There are numerous reports in the literature that dryland crops are more nutritive than the produce of irrigated lands. Hence, to harvesting of the quality grain needs adequate nutrient supply and irrigation. As both these inputs have synergestic interaction, it will be helpful in maintaining stability and sustainability of quality wheat production for our own consumption and export.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy Research Farm of Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). The soil was sandy loam, having 0.38% organic carbon and pH 7.96. It was low in available N (160.70 kg/ha), medium in available P (8.37 kg/ha) and rich in available K (314.60 kg/ha). The treatments consisted of 3 level of irrigation in main plot, i.e., 2, 3 and 4 irrigation and 11 nutrient sources, viz. control, recommended dose of chemical fertilizer, FYM equal to 75 kgN/ha, FYM equal to 150 kgN/ha, FYM equal to 225 kgN/ha, vermin compost equal to 75 kgN/ha, vermi-compost equal to 150 kgN/ha, vermicompost equal to 225 kgN/ha, poultry manure equal to 75 kgN/ha poultry manure equal to 150 kgN/ha poultry manure equal to 225kgN/ha. These treatments were tried in strip plot design with four replication.The N content in FYM,Vermi compost and Poultry manure was 0.80, 1.25 and 2.25 in first year study and 0.85, 1.25 and 2.25 in second year of the study.The organic sources were applied 15 days before sowing and incorporated through land preparation in the soil as per treatment. As per experimental requirement, recommended dose of nitrogen was applied in the form of urea. Half dose of the recommended nitrogen was applied as basal dose and remaining half as top dressing after 1st irrigation during both seasons. Recommended dose of phosphorus and Zinc was applied at the time of sowing during both seasons.Clean seed of wheat cv. WH 283 was directly sown with the help of seed drill in rows 20 cm apart at the rate of 125kg/ha.Crop was sown on 5th and 2nd December during the first and second year. Irrigation was applied in the field as per treatments.The weeds were removed by long tine hoe at 40 DAS and later by hand puling from time to time in all the plots throughout the crop season.Yield,NPK uptake and nutrient use efficiency of wheat were evaluated after harvest of the crop.

RESULTS AND DISCUSSION

Yield

The application of irrigation significantly enhanced the grain, biological and straw yield of wheat in both the years (Table 1). The maximum grain, biological and straw yield was obtained with four irrigations, which was significantly higher as compared to two and three irrigations during both the years. However, the harvest index of wheat was not influenced by the different levels of irrigation in both the years. Yield of wheat increased with increase in irrigation frequency

Table 1: Effect of Different Sources of Nutrition and Irrigation Levels on Yield of Wheat

Treatment	Grain Yield (kg ha^{-1})		Pooled	Straw yield (kg ha^{-1})		Biological yield (kg ha^{-1})		Harvest Index (%)	
	2005-06	2006-07		2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
I_1	3239	3311	3275	4496	4673	7736	7984	42.0	41.4
I_2	3643	3782	3713	5010	5275	8653	9058	42.0	41.8
I_3	3868	4060	3964	5047	5488	8915	9547	43.4	42.5
CD at 5%	107	107	57	318	357	267	332	NS	NS
T_1	2492	2592	2542	3984	4071	6476	6663	38.6	38.9
T_2	4113	4218	4166	5307	5646	9420	9864	43.7	42.8
T_3	3071	3249	3160	4330	4702	7401	7951	41.8	40.9
T_4	3617	3765	3691	4728	5332	8345	9096	43.4	41.5
T_5	3906	4012	3959	5139	5531	9045	9542	43.2	42.2
T_6	3236	3347	3291	4596	4773	7832	8119	41.5	41.4
T_7	3745	3849	3797	4841	5344	8586	9193	43.6	42.0
T_8	3914	4183	4048	5122	5491	9036	9675	43.3	43.2
T_9	3366	3451	3409	4717	4814	8084	8265	41.9	41.8
T_{10}	3828	3959	3894	5157	5254	8985	9214	42.7	42.9
T_{11}	4130	4269	4199	5440	5644	9569	9912	43.2	43.3
CD at 5%	230	179	137	439	468	381	431	3.4	2.8

from I_1 to I_3 because of higher crop growth in I_3. Similar results were observed by Shiwani *et al*., 2003 and Ingle, *et al*., 2007.

Application of poultry manure equal to 225 kg N/ha being at par with T_2 and T_8 in both the years and T_5 in first year only in relation to grain yield. However, poultry manure (T_{11}) recorded significant increase in grain yield over T_1, T_3, T_4, T_6, T_7, T_9 and T_{10} in both the year. Poultry manure @ 225 kg N/ha and recommended dose of chemical fertilizer along with FYM equal to 225 kg N/ha and vermicompost equal to 225 kg N/ha in second year produced significant increased in biological yield over poultry manure @ 75 kg N/ha (T_9) and 150 kgN/ha (T_{10}), vermicompost @ 75 kg N/ha (T_6) and 150kg N/ha (T_7), FYM @ 75 kg N/ha (T_3) and 150kg N/ha (T_4). Straw yield was recorded maximum with the application of poultry manure (T_{11}). Application of poultry manure equal to 225 kg N/ha being at par with T_2, T_5, T_8 and T_{10}, and significantly higher than T_1, T_3, T_4, T_6, T_7 and T_9 in first year. Whereas, application of recommended dose of chemical fertilizer (T_2) being at par with T_4, T_5, T_7, T_8, T_{10} and T_{11}, and was significantly increased over control, FYM, vermicompost and poultry manure @ 75 kg N/ha in second year. Application of recommended dose of chemical fertilizer (T_2) being at par with all the levels of organic sources and significant over the control in first year in relation to harvest index. Harvest

index was recorded maximum with the application of poultry manure @ 225kg N/ha (T_{11}). Application of poultry manure (T_{11}) being at par with T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and T_{10}, and was significantly increased over control. Same result was observed by Kharub and Chander, 2008 and Rani *et al*., 2009. Poultry manure was reported the best sources among the all organic sources because of higher concentration of N that is readily available to crop. It was observed that approximately 40% of total N in poultry manure would be in available form (Shepherd and Withers, 1999).

Nutrient Uptake

Nutrient uptake by wheat was affected significantly due to various treatments.The data on nutrient uptake in Table 2 reveals that N, P and K uptake was more in 2006-07 than in 2005-06. The N, P and K uptake increases significantly with the increased levels of irrigation. Maximum value of N (93.5 and 99.9), P (22.15 and 23.64) and K (91.0 and 92.0) uptake was recorded during 2005-06 and 2006-07 respectively, with highest level of irrigation, i.e., 4 irrigations (I_3), which differed significantly from 2 irrigations (I_1) during both the years. Similar trend have been observed by Ingle *et al*., 2007. Different levels and sources of nutrition have significant variation in N, P and K uptake during both the year. The maximum N (101.0 and 105.9 kg/ha) and K (94.6 and 95.5 kg/ha) uptake was recorded during 2005-06 and

Table 2: Effect of Different Sources of Nutrition and Irrigation Levels on NPK Uptake by Wheat

Treatments	N Uptake		P Uptake		K Uptake	
	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
I_1	78.7	80.8	18.51	19.16	77.5	78.8
I_2	88.2	93.6	20.99	22.11	86.0	87.7
I_3	93.5	99.9	22.15	23.64	91.0	92.0
CD at 5%	6.2	6.7	1.46	1.51	5.4	5.8
T_1	60.1	63.1	14.15	14.72	66.3	67.1
T_2	99.6	103.9	23.96	25.19	93.9	95.4
T_3	74.1	79.4	17.41	18.43	76.5	77.5
T_4	86.7	93.1	20.41	21.79	85.0	86.6
T_5	95.0	99.9	22.74	23.71	91.2	92.7
T_6	78.6	81.7	18.45	19.63	78.9	79.4
T_7	90.1	95.3	21.56	22.70	85.8	87.3
T_8	95.7	103.8	23.08	25.01	91.0	93.8
T_9	80.5	83.2	18.88	19.49	81.0	81.7
T_{10}	93.2	96.6	21.60	22.55	89.0	90.4
T_{11}	101.0	105.9	23.82	24.80	94.6	95.5
CD at 5%	5.7	5.6	1.44	1.18	9.7	10.2

2006-07 respectively, with the application of poultry manure equal to 225 kg N/ha. However, the maximum value of P (23.96 and 25.19 kg/ha) uptake was recorded during 2005-06 and 2006-07 respectively, with the application of recommended dose of chemical fertilizer. Similar result have been reported by Sharma *et al.,* 2005 and Singh and Yadav, 2006.

Nutrient Use Efficiency

The Nitrogen agronomical efficiency, physiological efficiency, apparent recovery and nitrogen use efficiency was computed with grain yield, biological yield, dose of N applied under different irrigation levels is given in Table 3. Agronomical efficiency and nutrient use efficiency increased with increase in irrigation level during both the years with non-significant difference. Apparent recovery efficiency increased and physiological efficiency decreased significantly with increase in irrigation level during 2005-06 and 2006-07. Among the different level of organic sources of nutrients the increase in the dose of N applied through different sources decrease the agronomical, physiological, apparent recovery and nutrient use efficiency during both the years. The maximum agronomical, physiological, apparent recovery and nutrient use efficiency was recorded with the application of poultry manure @75kgN/ha during both the year except physiological efficiency in second year and it was maximum with the application of vermicompost @75 kgN/ha. Agronomical, physiological, apparent recovery and nutrient use efficiency of inorganic source and organic sources applied @150 and 225 kgN/ha were non-significant during both the years except physiological efficiency in

Table 3: Effect of Different Sources of Nutrition and Irrigation Levels on Agronomical, Physiological, Apparent Recovery and Nutrient Use Efficiency of Wheat

Treatments	Agronomical Efficiency (kg/kg)		Physiological Efficiency (kg/kg)		Apparent Recovery Efficiency (%)		Nutrient Use Efficiency (%kg/kg)	
	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
I_1	6.94	7.62	83.9	85.3	17.7	18.9	1456	1487
I_2	8.74	8.16	75.8	84.5	21.4	21.4	1511	1769
I_3	9.74	10.41	72.2	80.3	22.8	25.0	1571	1844
CD at 5%	NS	NS	9.5	4.2	4.4	5.7	NS	NS
T_2	10.80	10.84	77.2	84.7	26.3	27.2	1963	2134
T_3	7.71	8.76	76.2	88.7	18.7	21.8	1233	1717
T_4	7.50	7.82	74.1	82.6	17.7	20.0	1286	1622
T_5	6.28	6.31	73.1	82.3	15.9	16.3	1105	1280
T_6	9.92	10.06	79.8	89.3	24.7	24.8	1808	1942
T_7	8.35	8.38	80.0	87.5	19.9	21.5	1406	1687
T_8	6.32	7.07	75.0	76.7	15.8	18.1	1138	1338
T_9	11.65	11.46	81.4	84.3	27.2	26.8	2143	2136
T_{10}	8.90	9.12	78.3	81.6	22.1	22.4	1672	1700
T_{11}	7.28	7.45	77.8	76.0	18.2	19.0	1375	1444
CD at 5%	2.32	1.89	6.3	7.0	4.2	5.3	398	378

second year. Similar result have been reported by Singh *et al*. (1997).

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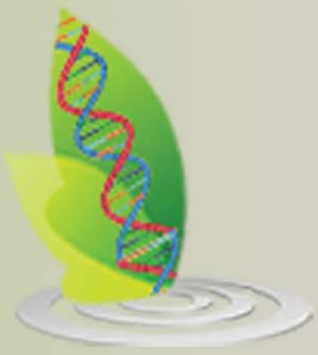

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