Pakistan J. Sci. Ind. Res., Vol. 30, No. 7, July 1987

EVALUATION OF POTASH APPLICATION TO WHEAT CROP IN SOUTHERN PUNJAB

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(Received July 8, 1985, revised June 14, 1987)

The influence of potash on grain yield and its components of wheat cultivar "Punjab-81"was studied under the irrigated conditions of southern Punjab. Potash as potassium sulphate applied before sowing increased grain yield per unit area by approximately 5 %. Most of the effect of potassium on grain yield occurred through increased number of grains per spike and 1000 grain weight.

There was little effect of potassium application on the number of tillers per unit area and number of spikelets per spike. The grain yield increased with increasing levels of nitrogen phosphorus and potassium. The application of potassium was economically beneficial when applied with urea and single superphosphate.

Key words: Triticum aestivum; potassium response; silt loam soil; Southern Punjab, economic response.

INTRODUCTION

Fertilizer is the crucial input for wheat production as it plays a vital role in increasing yield per acre. Wheat crop is normally sown after harvesting cotton, rice and sugarcane. The use of nitrogenous and phosphatic fertilizers is common. Farmers always try to increase production per unit area by increasing the rate of nitrogen and/or phosphatic fertilizer. Our farming community is not well aware of the role of potash fertilizer in modern crop production. The responses of crops to potash fertilizer are economical in Pakistan [1]. Rehman *et al.* [2] reported that the application of potash is more profitable than doubling the rate of nitrogen for wheat crop grown in Peshawar. Other researchers [3] also recorded positive response of wheat to potash fertilizer in Peshawar district. This may be due to the evolution of new high yielding cultivars of wheat which are more responsive to potash fertilizer. Moreover, the potash content of the soils has been depleting due to continuous and intensive cropping [4,5]. The farmers are not adopting the potash application due to resources constraints. Some of the farmers pointed out that they are not getting any response to potash application. Keeping in view the research recommendations and the farmer's problems, study was undertaken at Adaptive Research Farm, Vehari to evaluate the impact of potash application to wheat crop.

Bair and Sonetankova [6] reported that potassium fertilizer at the rate of 50,66 and 100 Kg/ha applied to winter wheat, spring barley and oats, resulted in enhanced grain yields. The maximum grain yield of 36.3 quintal per ha. with the application of 100 kg nitrogen, 50 kg P_2O_5 and 25 Kg K_2O per ha. to wheat [7]. Hussain [8] stated that the application of 120 Kg N, 60 Kg P_2O_5 and 60 Kg K_2O/ha proved the best combination in all respects for obtaining high and economic yield of wheat. Other researchers [9] found that the application of potassiam significantly increased 1000 grain weight of wheat and maize. Arshad [10] reported the effect of NPK and their method of application on growth and yield of Lyallpur-73 and observed that application of 100 kg N, 50 kg P_2O_5 and 50 kg K_2O per hectare resulted in significant increase in the stand density, fertile tillers, grains per spike and 1000 grain weight.

MATERIALS AND METHODS

The investigations were carried out on an alkaline calcareous alluvial soils in southern Punjab under irrigation. The fertilizer trial was conducted for three consecutive seasons (1981-84). Soil samples were collected from 0.30 cm. depth at pre-plant stage during each season. The physical and chemical characteristics of the investigated soils were determined according to methods described by the U.S. Salinity laboratory Staff [11] unless otherwise mentioned. The particle size distribution was determined by the hydrometer method [12] and textural class according to the USDA system. The available phosphorus was deter-

mined by the method given by Olsen *et al.* [13] and other methods described [14]. The results are given in Table 1.

The recommended wheat cultivar Punjab-81 of the area was sown on a well prepared seed bed in 23 cm apart rows with a single row hand-drill in the last week of November in an experimental unit 56 m^2. The system of layout was a randomized complete block design with four replications. The seed rate used was 110 kg per hectare. The whole quantity of phosphorus and potassium was broadcast and incroporated in the soil by ploughing before the seeding of wheat while nitrogen was applied into two doses : half at sowing and half with first irrigation. Details of the fertilizer treatments are given in Table 2.

Standard crop husbandry practices were followed during the whole growth period. Grain yield and other data were recorded plotwise at maturity at the end of April. The data were subjected to statistical analysis according to methods described by steel and Torrie [15].

Table 1. Phsico-chemical analysis at pre-planting stage (0-30 cm depth)

pH (0.01 M Ca Cl_2)	8.3
ECex 10^3	0.23
$CaCO_3$ (%)	6.8
Organic carbon (%)	0.38
Total nitrogen	0.02
Available phosphorus (ppm) ($NaHCO_3$ extracted)	8.1
Available potassium (ppm) (NH_4) AC method) =	188
Texture	Silt loam

Table 2. Influence of different doses of potassic fertilizer on the number of tillers per m^2

Nutrient dose (Kg/ha)			Seasons		Mean	
N	P	K	1981-82	1982-83	1983-84	
0	0	0	425	355	345	375
23	23	0	473	403	393	423
23	23	11	478	408	398	428
34	23	0	481	411	401	431
34	23	18	503	433	423	453
46	34	0	518	448	438	468
46	34	27	533	463	453	483
LSD (P = 0.05)			37 59	37 46	27.62	24.39
LSD (P = 0.01)			51.55	51.38	37 88	33.45
S.E. of two means			17.90	17.84	13.15	11.61
C.V.%			5.20	6.05	4.57	3.76

RESULTS AND DISCUSSION

A statistical analysis of the data provided in Tables 2 and 3 indicates that different doses of potassic fertilizer did not produce any significant effect on the number of tillers per unit area and the number of spikelets per spike in the presence of nitrogenous and phosphatic fertilizer. However, the addition of potassium differed significantly compared to control (no fertilizers). The maximum number of tillers per unit land area and the number of spikelets per

Table 3. Influence of different doses of potassic fertilizer on the number of spikelets per spike.

Nutrient dose (kg/ha).			Season		Mean	
N	P	K	1981-82	1982 83	1983-84	
0	0	0	15	15	17	15.66
23	23	0	16	17	18	17
23	23	11	16	17	16	16.33
34	23	0	17	18	16	17
34	23	18	18	18	19	18.33
46	34	0	17	18	18	17.66
46	34	27	17	18	19	18
LSD (P = 0.05)			N.sig	2 70	2.91	1.78
LSD (P = 0.01)			N.sig.	3.71	3.99	2.44
S.E. of two means			1.35	1.29	1.38	0.85
C.V. %			11.56	10.54	11.11	6.97

Table 4. Influence of different doses of potassic fertilizer on the number of grains per spike.

Nutrient dose (Kg/ha)			Season		Mean	
N	P	K	1981 82	1982-83	1983-84	
0	0	0	36	34	38	36
23	23	0	47	37	39	41
23	23	11	44	42	43	43
34	23	0	46	47	50	48
34	23	18	48	48	49	48
46	34	0	49	43	53	48
46	34	27	51	53	55	53
LSD (P = 0.05)			5.10	5.24	4.67	2.76
LSD (P = 0.01)			6.99	7.18	6.41	3.79
S.E. of two means			2.43	2.49	2.23	1.32
C.V.%			7.48	8.12	6.54	4.06

spike were obtained at the highest rates of N,P and K and it was maintained during three seasons.

Data presented in Tables 4, 5 and 6 indicate significant differences in the number of grains per spike, one thousand grain weight and grain yield due to the addition of potassium fertilizer treatments. The major increments in yield were due to nitrogen and phosphorus fertilizers. The response to potassium was positive and significant as compared to nitrogen and phosphates. It was reported that yield response of wheat to K fertilizer is attributed primarily to increased single grain weight, number of grains per year and to a lesser extent to the number of tillers per unit area [16]. It was further observed that increased K supply enhanced sink size and lengthen the grain filling period, which is ultimately reflected in increased grain yield [17].

Table 5. Influence of different doses of potassic fertilizer on 1000 grain weight (g).

Nutrient dose. (Kg/ha).			Season		Mean
N	P	K	1981-82	1982-83	1983-84
0	0	0	47.9	44.5	44.2	45.5
23	23	0	51.5	49.9	48.5	49.9
23	23	11	56.0	54.2	55.4	55.2
34	23	0	52.5	51.6	52.3	52.1
34	23	18	56.4	55.8	55.9	56.0
46	34	0	53.9	52.2	54.4	53 5
46	34	27	57.0	56.8	57.2	57.0
LSD (P = 0.05)			1.23	1.37	0.84	0.82
LSD (P = 0.01)			1.69	1.88	1.15	1.13
S.E. of two means			0.59	0.65	0.40	0.39
C.V. %			1.55	1.77	1.08	1.05

Table 6. Influence of different doses of potassic fertilizer on wheat grain yield (kg/ha)

Nutrient dose (kg/ha)			Season		Mean
N	P	K	1981-82	1982-83	1983-84
0	0	0	2487	2683	2660	2610
23	23	0	4513	2996	3380	3630
23	23	11	4609	3522	3680	3940
34	23	0	5056	3756	3668	4160
34	23	18	5148	4194	3919	4420
46	34	0	5362	4370	4253	4660
46	34	27	5466	4683	4521	4890
LSD (P = 0.05)			96.75	105.44	99.52	62.88
LSD (P = 0.01)			13.68	144.61	136.48	86 23
S.E. of two means			46.07	50.21	47 39	29.94
C.V. %			1.40	1.90	1.80	1.05

Table 7. Marginal economic analysis of fertilizer response data (per hr)

Net benefit (Rs/ha)	Fertilizer treatment N	$P2O_5$ (Kh/ha)	K_2O	Variable cost (Rs/ha)	Marginal increase in net benefit (Rs/hr)	Marginal increase in variable cost (Rs./ha)	Marginal rate of return %
9298	46	34	27	452	376	54	6.96
8922	36	34	0	398	403	77	5.23
8519	34	23	18	321	484	36	13.44
8035	34	23	0	285	401	39	10.28
7634	23	23	11	246	598	22	27.18
7036	23	23	0	224	1816	224	8.10
5220	0	0	0	–	–	–	–

Based on Rs. 200/10 Kg wheat grain; Urea = Rs. 128/50 Kg, SSP = Rs. 27/50 Kg and SOP = Rs. 50/50 Kg.

The yield forming components contributed greatly in achieving maximum yield and showed statistically significant response at balanced NPK dose over check. The results are in confirmity with those of Baker and Amberger [9] and Arshad [10] Response of wheat to NPK is well documented in the literature [18,19,20,21]. These result substantiate with those of Rehman, et al. [2], Khan, *et al.* [3], Blair, *et al.* [6], Ahmad [8] and Arshad [10].

An economic analysis of fertilizer doses according to Persin *et al.* [22] show the highest economic return for potassium. The maximum net return of Rs. 9298 per hectare was achieved by the addition of N-46, P-34, K-27 fertilizers. Many researchers [23,24] determined from a comprehensive review of K fertilizer experiments in India, USA and Canada that K fertilization decreased unit production costs and improved net returns. It is adviseable to farmers to add potassium fertilizer at the present prevailing price structure, as potassic resources are being continuously depleted due to intensive cropping system [4,5].

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