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**PJBS**

ISSN 1028-8880

**Pakistan  
Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Optimization of Potassium in Sunflower

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### Abstract

A field experiment was conducted to determine the optimum level of potassium on sunflower growth and yield. The potassium level comprised 0, 25, 50, 75, 100 and 125 kg per hectare while the sunflower hybrids were NK-265 and SF-187. The results showed that potash levels significantly influenced the head diameter, number of achenes per head, seed yield and protein contents, while plant height, 1000-achene weight and oil contents examined unaffected, statistically. The highest seed yield of 2.235 tones per hectare was obtained by applying 75 kg  $K_2O$  per hectare. For sunflower 75-100 kg  $K_2O$  per hectare is the optimum level, beyond this level the application of potash is not profitable and hybrid SF-187 is better than NK-265 as it showed better performance.

### Introduction

Potash is one of the essential elements for plant growth. Its role is well documented in photosynthesis, enzymatic activity, synthesis of proteins, carbohydrates and fats, translocation of photosynthates and enabling the plants to resist pests and diseases (Tisdale *et al.*, 1985). Potash also plays a key role in increasing crop yield and improving the quality of product.

Soils of Pakistan in general are made of such minerals which have large capacity to provide potassium to crops under normal conditions because of the dominance of illite clay minerals (Ranjha *et al.*, 1990). However, increased intensity of cropping and introduction of high yielding varieties resulted in considerable drain of potassium reserves and the crops are becoming responsive to potassium fertilization (Malik *et al.*, 1989). Seed yield increase by potassium has been reported however this fertilizer has no effect on oil concentration (Lewis *et al.*, 1991).

Comparatively sunflower has very high potassium requirements. Potassium applied in lower quantity than the optimum will not allow the crop to perform its physiological functions properly. On the other hand, potassium in absolutely high amount create some problems for the crop in addition to increase in the cost of production. The objective in this research was to determine the optimum potassium level and its effects on growth, yield and oil content of sunflower.

### Materials and Methods

This research was carried out at the Agronomic Research Station, University of Agriculture, Faisalabad, Pakistan in August 1995. The experiment was laid out in split plot design with three replications, keeping a net plot size of 1.8 m<sup>2</sup>. Nitrogen and phosphorus were applied as basal dose at the rate of 100 and 75 kg per hectare, respectively. Two sunflower hybrids (NK-265, SF-187) and six levels of potassium, 0, 25, 50, 75, 100 and 125 kg per hectare were used in this experiment to determine the optimum level of potassium. Urea, single super phosphate and

sulphate of potash were applied as fertilizer source for NPK. All P, K and half N were applied at the time of sowing. Remaining half N was applied at the time of first irrigation. Data obtained were analyzed statistically by using Fisher's analysis of technique, while significance of treatment means was tested by using least significance difference at 5 per cent level of probability (Steel and Torrie, 1984). The law of diminishing return was used to determine the optimum level of potassium by equating the inverse price ratio with marginal product (Sharma and Sharma, 1981).

### Results and Discussion

The effect of potassium on seed yield, head diameter, number of achenes per head and protein content was determined by analysis of variance. Results indicated that potassium treatment had significant ( $P < 0.01$ ) effects on all these characters. The sunflower hybrids had significant effect on yield and protein content. The interactions between hybrids and levels of potassium were non-significant for the attributes studied.

Data presented in Table 1(a) suggested that potash level of 75 kg per hectare gave the highest seed yield, head diameter and number of achenes per head. Similar results have been reported on the number of achenes per head. Similar results have been reported on the effect of potassium on yield, number of achenes per head (Lewis *et al.*, 1991, Tripathi and Kalra, 1981) and head diameter (Khan, 1990). As far as the protein content are concerned higher levels of potassium significantly decreased the protein content. Different levels of potassium had non-significant effect on plant height, 1000-achene weight and oil content (Data not shown). Similar results for effect of K on oil content reported by Lewis *et al.* (1991). Hybrid NK-265 gave significantly higher yield and protein content than SF-187 (Table 1 b).

Optimum level of potassium was determined by equating inverse price ratio with marginal products (Table 2), which showed the optimum rate of potash is in the range of 75-100 kg per hectare.

For sunflower 75-100 kg  $K_2O$  per hectare is the optimum

Chaudhry and Mushtaq: Optimum, potassium sunflower

Table 1: Effect of different levels of potassium on yield, yield components and protein contents in two sunflower hybrids.

Treatment	Seed yield (t per ha)	Head diameter (cm)	No. of achenes per head	Protein content (%)
0	1.530 b	15.517 c	560.167 c	24.190 a
25	1.547 b	15.992 c	741.00 b	23.705 ab
50	1.608 b	16.283 bc	729.00 b	24.655 a
75	2.235 a	18.650 a	863.50 a	23.652 ab
100	1.690 b	17.367 b	737.83 b	23.007 b
125	1.600 b	16.322 b	705.16 b	22.888 b
LSD (0.05)	0.222	1.226	68.81	1.053
NK-265	1.570 a	16.694 ns	696.66 ns	23.980 a
SF-187	1.829 b	16.682 ns	748.88	23.386 b
LSD (0.05)	0.111	-	-	0.308

NS = Non-significant; Any two means no sharing the common letter differ significantly at 5% level of probability.

Table 2: Marginal product and inverse price ratio at different levels of potassium application for two sunflower hybrids.

Level of use (kg/ha)	Yields (kg/ha)		Marginal product		Inverse price ratio of price of K and sunflower seed are Rs. 22.00 and Rs. 20.00 respectively.
	Hybrid NK-265	Hybrid SF-187	Hybrid NK-265	Hybrid SF-187	
0	1420	1640			1.10
25	1420	1670	0.00	1.20	1.10
50	1490	1720	2.80	2.00	1.10
75	2270	2530	31.20	32.40	1.10
100	1650	1730	-24.80	-32.00	1.10
125	1520	1680	-5.2	-2.00	1.10

level, beyond this level the application of potash is not profitable and hybrid SF-187 is better than NK-265 as it showed better performance.

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