Sarhad J. Agric. Vol.27, No.4, 2011

RESPONSE OF SEED YIELD OF CORRIANDER TO PHOSPHORUS AND ROW SPACING

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ABSTRACT

Response of seed yield of corriander to phosphorus and row spacing was studied at Malakandhare, Horticulture Farm, Agricultural University, Peshawar, Pakistan during the year 2002-03. Four levels of phosphorus (0, 15, 30 and 45 kg/ha) were applied at four different row spacings (15, 25, 35 and 45 cm). The result indicated that different levels of phosphorus and row spacing had significant effect on all parameters, however, their interaction effect was non significant in most parameters with the exception of the seed yield hectare^{-1}. Maximum numbers of umbels plant^{-1} (47.00) and 1000 seed weight (10.32 g) were obtained with 45 kg P/ha at 45 cm row spacing. Whereas, the maximum days to first umbel maturity (30.0) and days to last umbel maturity (25.33) were recorded in control treatments. However, maximum seed yield (1360.0 kg/ha) was obtained when 45 kg P/ha was applied at row spacing of 25 cm.

Key Words: **Corriander, Seed Yield, Phosphorus and Row Spacing**

Citation: Jan, I., M. Sajid, A. H. Shah, A. Rab, N.H. Khan, F.I. Wahid, A. Rahman, R. Alam and H. Alam. 2011. Response of seed yield of corriander to phosphorus and row spacing. Sarhad J. Agric. 27(4): 549-552

INTRODUCTION

Coriander (*Coriandrum sativam* L) is a member of *Apiaceae* (*Umbelliferae*) family. The term coriander came from the Greek word, koris, meaning bedbug because the leaves and green fruit of this plant have an odor similar to bedbugs. In Khyber Pakhtunkhwa, during the previous decade (1991-2001) the area under coriander production reduced from 200 to 100 hectare, however, the production remained the same. (Agric. Statistics of Khyber Pakhtunkhwa, 2000-01). Coriander plant yields both the fresh green herb as well as spice seed. Phosphorus plays an important role in photosynthesis, respiration, energy storage, cell division/enlargement and several other processes like seed formation, hastening maturity and also contributes to disease resistance in coriander (Preeke and Sethi, 1985). The effect and requirement of phosphorus on coriander seed crop were studied by Baboo and Rana (1995) who noticed that the application of 30 kg P_2O_5 hectare^{-1} proved better in respect of yield and net return than either 0 or 60 kg hectare^{-1}. Phosphorus application as single super phosphate at 0, 15, 30 or 45 kg per hectare along with nitrogen (as urea) at 0, 20, 30 or 60 kg per hectare to coriander crop by Tiwari and Banafar (1995) have shown an increase in coriander seed yield. The effect of row spacing on seed yield and quality parameters were studied by Choudary *et al.* (1995) who obtained highest seed yield, 1000seeds weight and seed viability in the coriander crop planted at 30 cm row spacing as compared to 15 cm spacing. Sharma (1996) reported that the phosphorus application did not influence seed yield, however, N application up to 120 kg per hectare increased seed yield. Sivakumaran *et al.* (1996) conducted a field experiment with different levels of N (20, 40 or 60 kg per hectare), P (0 or 30 kg per hectare) and S (0 or 10 kg per hectare). He noticed the synergistic effects between N and P, and N and S. Similarly the essential oil yield was also influenced by N, P and S application.

MATERIALS AND METHODS

Response of seed yield of corriander to phosphorus and row spacing was studied at Malakandhare, Horticulture Farm, Agricultural University, Peshawar, Pakistan during 2002-03. Seed was sown on November 12, 2002 and before application of fertilizer soil samples were analyzed in Laboratory of Soil Science Department, Agricultural University, Peshawar, Pakistan. The result of analysis is given in the following table.

Soil characteristics of the experimental field as evaluated in Lab

Soil Texture Class	**Clay loam**
Percent Nitrogen (N)	0.0876 ppm
Phosphorus (P_2O_5)	0.87 ppm
pH	7.9

The experiment was laid out on a two-factor factorial randomized complete block design with 16 combinations of treatments replicated three times. Each plot size was 2×2m. The rate of Nitrogen application was kept constant (80 kg per hectare) with different levels of phosphorus (0, 15, 30 and 45 kg per hectare).

RESULTS AND DISCUSSION

Number of Umbels per Plant

It is clear from the (Table I) that maximum number of umbels plant^{-1} (40.50) were counted with the application of phosphorus at 45 kg per hectare, while, minimum number of umbels plant^{-1} (28.75) were recorded in control. Nwadukwe and Chuude (1995) also noted significant effects of N and P on number of umbels plant^{-1}. The data pertaining to row spacing showed that maximum number of umbels plant^{-1} (40.75) were noted at 45 cm row spacing, while, minimum umbels plant^{-1} (27.75) were counted in control. This was probably due to the availability of more space to the plant at which plant could spreads more and could produce more branches resulting in more number of umbels per plant. Nearly similar results have also been reported by Jat *et al.* (1996) who obtained highest number of umbels plant^{-1} at row spacing of 40 cm. The interaction of phosphorus and row spacings was statistically non significant. However, the maximum number of umbels plant^{-1} (47.00) were recorded with the application of phosphorus at 45 kg hectare^{-1} and 45 cm row spacing, whereas, minimum number of umbels plant^{-1} (24.00) were seen in control. Reddy and Rolston (1999) also noted a decline in number of umbels plant^{-1} with the increase in pant density in the row spacing.

Table I ***Number of umbels plant^{-1} as affected by levels of phosphorus and row spacing***

Row spacing (cm)	Levels of phosphorus (kg/ha)				Means
	0	15	30	45	
15	24.0	27.0	27.0	33.0	27.75 D
25	26.0	31.0	33.0	39.0	32.25 C
35	28.0	37.0	39.0	43	36.75 B
45	37.0	37.0	42.0	47.0	40.75 A
Means	28.75 C	33.0 B	35.25 B	40.50 A	

LSD value at 1% for levels of phosphorus = 3.53
LSD value at 1% for levels of row spacing = 3.53

Days to first Umbel Maturity

The Table II revealed that the first umbel matured in minimum number of days (23.08) when phosphorus was applied at 45 kg hectare^{-1}, while maximum days to first umbel maturity (28.25) were taken in control (Table II). Arya *et al*. (1999) also obtained the similar results and stated that phosphorus induced early maturity and therefore, days to umbel maturity were less with higher dose of phosphorus. The effect of row spacing was though significant. However, minimum days to first umbel maturity (24.58) were counted at 45 cm row spacing, while maximum days to first umbel maturity (27.25) were taken in control. It could be attributed to the more availability and uptake of phosphorus at wider spacing and less amount availability and uptake at denser plantings resulting in induction of early maturity. The interaction of levels of phosphorus and row spacing was statistically non significant, however, minimum days to first umbel maturity (21.67) were taken by coriander with phosphorus 45 kg per hectare at row spacing of 45 cm, while, maximum days to first umbel maturity (30.00) were seen in control. It might have been due to the availability of higher phosphorus (45 kg hectare^{-1}) at wider row spacing (45 cm), which induced early maturity.

Table II ***Days to first umbels maturity as affected by levels of phosphorus and row spacing***

Row spacing (cm)	Levels of phosphorus (kg ha^{-1})				Means
	0	15	30	45	
15	30.0	27.33	27.0	24.67	27.25 A
25	28.0	25.33	25.0	23.33	25.42 B
35	27.67	27.0	24.67	22.67	25.50 B
45	27.33	23.33	26.0	21.67	24.58 B
Means	28.25 A	25.75 B	25.67 B	23.08 C	

LSD value at 1% for levels of phosphorus = 1.252
LSD value at 1% for levels of row spacing = 1.252

Days to last Umbel Maturity

The data (Table III) reveals that maximum days to last umbels maturity (21.67) were recorded in control; however, minimum days to last umbel maturity (18.75) were taken by coriander with the application of phosphorus at 45 kg per hectare. Arya *et al.* (1999) also obtained the similar result and stated that phosphorus induced early

flowering and maturity and therefore, days to first appearance were also less at higher dose of phosphorus. The effect of row spacing was also significant and minimum days to last umbel maturity (17.58) were counted at 45 cm row spacing followed by 35 cm, while, maximum days to last umbel maturity (22.75) were noted in control. Since the denser panting (spacing 15 cm) reduced the space at which low plant spread occurred which might reduced the amount of nutrient utilization and delayed the attainment of reproductive growth leading to delayed appearance of last umbels and hence delayed maturity. Though the interaction of phosphorus and row spacing was statistically non-significant however, minimum days to first umbels maturity (16.00) were recorded with the application of phosphorus at 45 kg hectare^{-1} at 45 cm row spacing, whereas, maximum days to last umbel maturity (25.33) were counted in control, which could be attributed to the higher phosphorus availability at wider spacing (45 cm) which had induced early maturity. These results to a greater extent resemble with those of Arya *et al.* (1999) who observed early flowering and early maturity with higher doses P and K (Table III).

Table III ***Days to last umbel maturity as affected by levels of phosphorus and row spacing***

Row spacing (cm)	Levels of phosphorus (kg ha^{-1})				Means
	0	15	30	45	
15	25.33	21.67	20.33	19.33	22.75 A
25	23.67	20.67	19.00	17.00	20.92 B
35	22.00	20.67	17.00	18.00	18.67 C
45	20.00	20.67	18.33	16.00	17.58 C
Means	21.67 A	20.80 B	19.42 B	18.75 B	

LSD value at 1% for levels of phosphorus = 1.449
LSD value at 1% for levels of row spacing = 1.449

1000 Seed Weight (g)

The effect of different phosphorus levels as well as row spacing on 1000 seeds weight was statistically significant (Table IV); however, these variations were not large. Maximum 1000 seeds weight (9.83 g) was measured with the application of phosphorus at 45 kg hectare^{-1}, while, minimum 1000 seeds weight (8.59 g) was recorded in control. As the phosphorus has a vital role in the seed development and hence it positively affected the 1000 seeds weight which was maximum with 45 kg hectare^{-1}. Vinay *et al.* (1999) also obtained 500 seeds weight with the highest nitrogen and phosphorus dose. Maximum 1000 seeds weight (9.55 g) was found in plants grown at wider row spacing (45 cm), while, minimum weight of thousand seeds (8.60 g) was measured in control. The increase in seed weight at wider spacing was due to the penetration of more light, more available nutrient and moisture, less competition between plants for nutrients and water which resulted in more plant growth and hence greater seed size. Choudry *et al.* (1995) also obtained the highest 1000 seeds weight at wider spacing (30 cm). Though the variations 1000 seeds weight due to the interaction of phosphorus levels and row spacings were statistically non significant, however, maximum weight of thousand seeds (10.32 g) was recorded with 45 kg hectare^{-1} phosphorus at 45 cm row spacing, while minimum weight of thousand seeds (8.00 g) was found in control. These non significant differences in 1000 seeds weight due to the interaction of P levels and row spacing were probably due to larger error degree of freedom and also the environmental changes occurring at the later stage of crop growth.

Table IV ***1000 seed weight (g) as affected by levels of phosphorus and row spacing***

Row spacing (cm)	Levels of phosphorus (kg ha^{-1})				Means
	0	15	30	45	
15	8.00	8.67	8.03	9.35	8.60 B
25	8.17	8.70	8.06	9.73	8.78 B
35	8.53	8.50	8.43	9.94	8.94 B
45	9.66	8.72	9.31	10.32	9.55 A
Means	8.59 B	8.62 B	8.84 B	9.83 A	

LSD value at 1% for levels of phosphorus = 0.4897
LSD value at 1% for levels of row spacing = 0.4897

Seed Yield Hectare^{-1} (kg)

The results pertaining to seed yield per hectare were significant. Maximum seed yield (1123.0 kg hectare^{-1}) was obtained with 45 kg P hectare^{-1}, whereas, minimum seed yield (894.0 kg hectare^{-1}) was recorded in control (Table V). Since the application of phosphorus significantly increased the number of umbels plant^{-1}, 1000 seeds weight and also enhanced seed maturity as compared to control. So, seed yield per hectare with the highest dose of phosphorus (45 kg hectare^{-1}) is no strange. Similar results have also been reported by Tiwari and Banafar (1995) who recorded maximum seed yield per hectare with 45 kg P hectare^{-1} and also by Nwadukwe and Chude (1995) who got significant higher seed yields with 50 kg P hectare^{-1} and 50-100 kg N hectare^{-1}. Singh *et al*. (1971), Ghosh *et al.*

(1985) have also reported similar results. The effect of different row spacings were also statistically significant, however, maximum seed yield (1036.0 kg hectare^{-1}) was obtained at 25 cm row spacing instead of 45 cm spacing at which the seed yield was minimum (916.8 kg hectare^{-1}). This was probably due to higher plant density at 25 cm where more plants per unit area added to higher seed yield. These results to a grater extent coincide with those of Jat *el al*. (1996) who obtained the highest seed yield at row spacing of 30 and 20 cm. The results of Nehra *et al*. (1998) are also in agreement with us. The interaction of phosphorus levels and row spacing was significant but maximum seed yield (1360.0 kg hectare^{-1}) was recorded with 45 kg P hectare^{-1} at 25 cm row spacing, whereas, minimum yield (777.5 kg hectare^{-1}) was obtained in control treatment. The reason for these variations was the higher plant density and higher amount of phosphorus, which increased the number of umbels per plant and hence added to the higher seed yield of corriander.

Table V ***Yield hectare^{-1} (kg) as affected by levels of phosphorus and row spacing***

Row spacing (cm)	Levels of phosphorus (kg ha^{-1})				Means
	0	15	30	45	
15	777.5 f	956.7 ce	885.0 df	1120.0 b	934.8 B
25	910.0 de	913.5 de	962.0 ce	1360.0 a	1036.0 A
35	908.3 df	873.0 df	962.3 ce	1050.0 bc	948.8 B
45	980.0 cd	883.0 df	963.3 ce	1050.0 bc	916.8 B
Means	894.0 B	906.8 B	913.5 B	1123.0 A	

LSD value at 1% for levels of phosphorus = 65.98 LSD value at 1% for levels of row spacing = 65.98
LSD value at 5% for interaction = 132.0

CONCLUSION AND RECOMMENDATIONS

It is concluded from the present results that Phosphorus at the rate of 45 kh ha^{-1} should be used for the high seed production of corriander planted at space of 25 cm.

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