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RESPONSE OF CORIANDER (*Coriandrum sativum* L.) TO DIFFERENT NITROGEN LEVELS AND SOWING DATES

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ABSTRACT

Field experiment for different levels of nitrogen and sowing dates for coriander crop was performed under field conditions during year 2011-12. Sowing of Coriander was practiced on three dates with fortnight interval from 20th October to 20th November). Nitrogen fertilizer was applied at four levels of 0, 20, 40 and 60 kg ha^{-1}. Maximum days to germination, plant height, number of days to first umbel maturity and seed yield kg ha^{-1} were observed in plants provided with at 60 kg ha^{-1} nitrogen at 5th November sown crop, hence recommended for better production of coriander under the agro climatic conditions of Swat.

Keywords: Coriander (*Coriandrum sativum* L.), Nitrogen levels and sowing dates.

INTRODUCTION

Regarding low yield of coriander in Pakistan, several factors are responsible. Appropriate sowing time and judicious use of fertilizers are of supreme importance in this regard. This crop has its own requirement for low temperature and light to precede germination, growth and maturity. Its need of low temperature initially could be observed in early sowing as temperature is above optimum which adversely affects germination due to the action of several bacteria and fungi on embryo and endosperm. This mainly happens by the activities of fungi and bacteria encouraged by temperature above optimum (Naeem et al., 2002). Late crop sowing results in less number of branches per plant and poor or stunted crop growth due to severe low temperature. In order to obtained higher yield of coriander, there is need to improve the efficiency of available land by judicious use of fertilizers and selection of proper sowing time. Soil fertility and crop productivity could be improved by proper nitrogenous fertilization (Akanbi et al., 2001).

Application of nitrogen fertilizer improved seed yield and biomass of coriander by 43-68% and 25-42%, respectively (Heng et al., 2001). Various production factors are responsible for improving crop yield, however, nutrient management the most important significantly affecting yield in crops. Low crop productivity in recent years is mainly attributed to decline in fertility status of the soil. Major problems faced by farmers in maintaining soil fertility are, shortage in production of fertilizer and availability at required times. Due to variation in yield potential of different soils, ensuring proper nutrient supply throughout the growing season is the greatest challenge of the day for agriculture scientist. For sustainability in crop production and improvement in soil health, balanced fertilization is very important (Sharif et al., 2004). Nitrogen fertilization plays major role in crop yield improvement with better plant health (Kizil and Ipek, 2004). Regarding various nutrients, nitrogen is the most limiting nutrient and coriander requires approximately 50 Kg N ha^{-1}. Efficient application of nitrogen from organic and inorganic sources effectively enhances yield and quality of coriander and soil health. Nitrogen as a fertilizer is consider the most limiting factor affecting marketable yields as well as nitrate accumulation in coriander. Application of excess nitrogen, however, is often much more than utilized by the plants. Higher nitrate build up due to arbitrary incorporation of nitrogen is getting importance as a public health concern. Considering the importance of nitrogen dose rate and effective sowing date for improved coriander crop yield, present study was planned under field conditions to find out the best sowing time and nitrogen application rate.

MATERIALS AND METHODS

The experimental plots were ploughed well and the soil sample was taken for analysis. Soil

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texture class was silt loam which contained (0.057) percent nitrogen, 41 mg kg^{-1} phosphorus (P_2O_5) and 1.59% organic matter. The pH and lime content ($CaCO_3$) were 6.4 and 2.40, respectively. Two factors (sowing dates and N application rates) were investigated in the course of experiment. Randomized complete block (RCBD) design was used with split plot arrangement with each treatment replicated three times. Corriander cultivar “Irani” was used with seed rate of 25 kg ha^{-1} on all three particular dates of sowing. Two factors were combined in various combinations and twelve treatments were formed. Field was divided in main and sub plots having sub-plot size of 1.2 m x 1m. Row to row distance was 30 cm. Urea was used as a source of nitrogen and diammonium phosphate (DAP) for phosphorus.. Following are detail of the treatment used in the course of study.

Sowing dates	***Nitrogen levels***
D_1:20th October	N_1: 0 kg ha^{-1}
D_2:5th November	N_2: 20 kg ha^{-1}
D_3:20th November	N_3: 40 kg ha^{-1}
	N_4: 60 kg ha^{-1}

All other cultural practices were kept constant for the treatments. Field was irrigated when needed. In order to avoid loses due to weeds infestation, hand weeding was done after twenty and fifty days of sowing.

The data recorded from different parameters were analyzed statistically using analysis of variance techniques appropriate for randomized complete block design with split plot arrangement. Means were compared using LSD test at 0.05 level of probability, when the F-values were significant. The statistical software GenStat release 8.1 was used for analysis of the data.

RESULTS AND DISCUSSION

Days to germination

Days to germination of coriander was affected by different sowing dates and nitrogen application (Table 1). There existed non-significant difference for different sowing dates but significant for nitrogen application. The interaction was, however, found non-significant. Maximum days to germination recorded in control treatment followed by treatments of 40 kg ha^{-1} and 60 kg ha^{-1} nitrogen levels and minimum in 20 kg ha^{-1}. Emergence of coriander was statistically similar in different sowing dates. Environmental conditions at the end of October is not that much warmer as compared to the temperature in mid of November. However, 20 kg ha^{-1} nitrogen application showed early emergence which might be the optimum range of nutrition for coriander.

Table I: ***Days to germination as affected by different Sowing dates and nitrogen levels***

Nitrogen	**Sowing Dates**			**Mean**
	20th Oct	**5th Nov**	**20th Nov**	
0	9	9	9	9a
20	7	8	7	7b
40	8	7	8	8ab
60	7	8	9	8ab
Mean	8	8	8	

LSD for nitrogen = 1.1316 CV (REP*SOW DATE) = 4.90
LSD for sowing dates= 0.4627 CV (REP*SOW DATE*NITROGEN) = 13.71

Plant height (cm)

Nitrogen application at 60 kg ha^{-1} resulted in tallest plants (132 cm) as compared to other treatments followed by that of 40 kg ha^{-1} (121 cm) (Table 2) while control plants resulted in short stature (96 cm). Higher plant height (118 cm) was recorded in plots sown on 5th November similar to 20th November (115 cm) but short stature (113 cm) in early sown plots (20th October). Height of plant affects crop growth in several ways and directly influences biological yield and total biomass. Higher plant height in N treated plots could be attributed to synergetic effect of N fertilization on vegetative growth of the plant (Tiwari et al., 2002). Possible reason for this increase is the fact that higher amounts of nitrogen trigger vigorous vegetative growth of crops (Carrubba et al., 2006). The superiority of higher N application over low N may be due to the fact that N incorporated plots utilized the water and nutrients in a better way resulted in optimum

plant growth and attributed to deeper and denser rooting or vigorous vegetative growth.
As planting were delayed, coriander plant height were increased and may be attributed to day length. Delay planted plants were more exposed to longer day which promoted more vegetative growth and maximum plant height was obtained.

Table II: ***Plant height as affected by different Sowing dates and nitrogen levels.***

Nitrogen	Sowing Dates			Mean
	20th Oct	5th Nov	20th Nov	
0	92	103.66	95	96.88d
20	111	111	117.33	113.11c
40	121.33	125.33	117.33	121.33b
60	129.33	133.66	133	132a
Mean	113.41b	118.41a	115.66b	

LSD for Nitrogen= 2.3768 CV (REP*SOW DATE) = 1.88
LSD for Sowing date= 2.4704 CV (REP*SOW DATE*NITROGEN) = 2.07

Number of days to first umbel maturity

Different N application rates and sowing dates significantly affected days to first umbel maturity of coriander with significant interaction (table 3). Days to first umbel maturity increased as N application rate increased from 0 to 60 kg ha^{-1}. Early maturity of first umbel was observed in plots where no N was applied. Similarly, N application at the rate of 60 kg ha^{-1} resulted in delay maturity and it took more days (70days) to first umbel maturity followed by (68 days) of N application at 40 kg ha^{-1} statistically at par (67 days) with N application at the rate of 20 kg ha-^{1}. Regarding sowing dates, early maturity of first umbel was observed in 20th October sowing plots (69 days) followed by (68 days) sowing on 5th November. Sowing of coriander on 20th November took (67 days) to first umbel maturity. The delay in maturity of first umbel in coriander might be attributed to vigorous growth and development of coriander because more nutrients were supplied and available in high nitrogen fertilizer plots. Nitrogen fertilization improved coriander and enhanced growing season. Later planting may delay progress of the crop which shortened the phonological developmental (Zheljazkov et al., 2008) and thus assumed earlier planting with greater time for phonological development than later plantations.

Table III: Days to first umbel maturity as affected by different Sowing dates and nitrogen levels

Nitrogen	Sowing dates			Mean
	20th Oct	5th Nov	20th Nov	
0	66.33	68.33	65.33	66.67c
20	68.33	67.66	67.33	67.77bc
40	70.33	68.33	66.33	68.33b
60	72.33	69.33	70.33	70.66a
Mean	69.33a	68.41ab	67.33b	

LSD for Sowing dates=1.4010 CV(REP*SOW DATE)= 1.81
LSD for Nitrogen= 1.6589 CV(REP*SOW DATE*NITROGEN= 2.45

Seed yield (kg ha^{-1})

Higher seed yield (162 kg ha^{-1}) were recorded in plots where N was applied at rate of 60 kg ha^{-1} followed by (152 kg ha^{-1}) in plots with 40 kg ha^{-1}. Control plots resulted in lower (126 kg ha^{-1}) seed yield. Sowing of coriander on 5th November resulted in maximum (148.5 kg ha^{-1}) seed yield followed by (146.3 kg ha^{-1}) 20th November while, sowing on 20th October produced minimum (141.41 kg ha^{-1}). Nitrogen application increased seed yield in linear manner and 60 kg ha^{-1} improved seed yield by 40% as compared to control. Reduction in yield due to lower fertilization might be attributed to nutritional imbalance and deficiency of certain important plant growth nutrients at various important growth stages like flowering, seed formation and seed maturity (Dierchesen, 1996). These results are in accordance with Singh et al. (2010) who suggested that timely availability of N could be insured and productivity can be positively increased.

Table IV: ***Seed yield (kgha^{-1}) as affected by different sowing dates and Nitrogen levels.***

Nitrogen	Sowing dates			Mean
	20th Oct	5th Nov	20th Nov	
0	124.67	127.66	126	126.11d
20	133	143.33	147.66	141.33 c
40	152	153	151	152b
60	156	170	160.66	162.22a
Mean	141.41 b	148.5 a	146.33 ab	

LSD for Sowing dates=5.2455 CV(REP*SOW DATE)= 3.18
LSD for Nitrogen = 4.9930 CV(REP*SOW DATE*NITROGEN)= 3.47

CONCLUSION AND RECOMMENDATIONS

Nitrogen application at the rate of 60 kg ha^{-1} with a sowing date of 5th November improved growth and yield of coriander. Considering all the factors of good crop production and yield, this dose rate with sowing date is recommended for the coriander growers of Swat valley.

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