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EFFECT OF DIFFERENT CROPPING PATTERN RATIO ON YIELD AND YIELD ATTRIBUTES OF CHICKPEA UNDER CHICKPEA + CORIANDER INTERCROPPING SYSTEM

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ABSTRACT

The present investigation was carried out during the year 2013-14 and 2014-15 in Aquic Hapludoll at D_6 block of Norman E. Borlogue Crop Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar. To find out the effect of intercropping of coriander on chickpea yield. The experimental design used were split plot design in which the main plots showed the planting pattern and sub plots represented the P – level. The experimental area comprising 16 treatments divided into 48 plots. These treatments comprised in combinations of 4 planting pattern and 4 levels of phosphorous. The seed rate for chickpea (variety Pant G-186) was 80 kg/ha and for coriander (variety Pant Haritima-1) it was 12 kg/ha. The row to row spacing was 30 cm for both the crops in sole planting. Main plot comprised four plots of cropping pattern (Chickpea sole, Coriander sole, Chickpea + coriander (3:1) in replacement series and Chickpea + coriander (4:2) in replacement series) and sub plots (Control, 30 kg P_2O_5 ha^{-1}, 30 kg P_2O_5 ha^{-1} + PSB and 45 kg P_2O_5 ha^{-1}) in the split plot design to check the effect of intercropping of coriander on chickpea yield and yield attributes. It was observed that treatments P30+PSB and P30 were at par in nodule number, nodule dry weight and plant dry weight (g) and significantly more over P0 and P45

treatments. The P30+PSB and P30 treatments were at par in grain, straw and biological yield and significantly more over P0 and P45 treatments and in cropping patterns whereas sole chickpea were significantly more than chickpea intercropping with coriander in 3:1 and 4:2 cropping pattern ratio. Both the sole crops (chickpea and coriander) gave significantly higher seed yield (2406 kg/ha in 2013-14 and 2488 kg/ha in 2014-15, respectively by chickpea) as compared to all other intercropping systems.

Introduction

Chickpea is the third most important pulse crop, after dry bean and peas, produced in the world. It accounts for 20% of the world pulses production. Major producers of chickpea include India, Pakistan, and Mexico, as per the latest available estimated of Food and Agricultural Organization (FAO), is about 12 million metric tons in 2011. Chickpea or Bengal gram or gram (*Cicer arietinum* L.) is most important pulse crop grown in our country. India is the largest producer of chickpea accounting to 75% of world production **(Nwange *et al.* 2011).** In India, it is major crop covering 8.41 million hectares of area (37.5% of the total area under pulses) with 6.68 million tones of production (47% of total pulse production). But there has not been any significant increase in area (7.75 million hectare) under chickpea at national level since 1969.70. The increase in production has mainly been due to increase in its productivity from 450 to 794 kg ha^{-1} **(Chaturvedi and Dua, 2001).** States like Jharkhand and Chhattisgarh are expanding their area and production of chickpea crop. In terms of productivity Andhra Pradesh (1239 kg ha^{-1}) followed by West Bengal (1179 kg ha^{-1}) and Bihar (1171 kg ha^{-1}) top the chart **(FAO, 2016-17).** Globally, India ranks first in area and production followed by Pakistan, Australia and Iran. The highest productivity of 6120 kg ha^{-1} is observed in Israel followed by Yemen. India productivity of Chickpea is 920 kg ha^{-1} **(FAO, 2016-17)**.

Coriander (*Coriandrum sativum*), also known as cilantro, Chinese parsley or dhania, is an annual herb in the family *Apiaceae*. All parts of the plant are edible, but the fresh leaves and the dried seeds are the parts most traditionally used in cooking. Chickpea seeds contain about 17-20% protein and form an important part of vegetarian diet. Coriander, like many spices, contains antioxidants, which can delay or prevent the spoilage of food seasoned with this spice. A study found both the leaves and seed to contain antioxidants, but the leaves were found to have a stronger effect **(Wengensteen *et al.*, 2004).**

Being practiced since long back, intercropping is a useful proposition for increasing the productivity and income per unit area/time in agriculture besides enhancing the water, land and nutrient use efficiency. This necessitates development of an appropriate intercropping technology for different crops especially minor crops which was grown on a limited area. With development of varieties suitable for cultivation in rice – fallow, like the bold seeded kabuli, sailinity tolerant and multiple diseases resistant varieties, it has become possible to stabilize the area and production of chickpea in India. To improve the overall productivity and stability, farmers often grow chickpea in association with other crops like barley, mustard, coriander, linseed and safflower. Magnitude of competition also varies with the agro climatic conditions. Further, both the crops differ in their nutrient absorption behavior and chickpea being a pulse crop may supplement nitrogen requirement of the component crops. The main objective of this study was to assess the effect of different cropping pattern on growth and development of chickpea and coriander.

Material and methods

The field experiment was conducted on mollisol soils at Norman E. Borlaug Crop Research Centre (C.R.C.), of the G. B. Pant University of Agriculture and Technology, Pantnagar during rabi seasons of 2013-14 and 2014-15 to study the effect of different cropping pattern practices on growth and development of chickpea and coriander. The 16 treatments combination of 4 planting patterns as main plots (C1- Chickpea sole, C2- Coriander sole, C3- Chickpea + coriander (3:1), C4- Chickpea + coriander (4:2) in replacement series) and 4 phosphorus levels and 4 phosphorus levels (P0- Control, P1- 30 kg P_2O_5 ha^{-1}, P2- 30 kg P_2O_5 ha^{-1} + PSB, P3- 45 kg P_2O_5 ha^{-1} as sub plots. The experiment was laid out in a Split Plot Design with three replications. The soil of the experimental field was loam having organic carbon 0.86%, available nitrogen 195 kg ha^{-1}, phosphorous 19.50 kg ha^{-1} and potash 210 kg ha^{-1} and EC 0.243 dSm^{-1} with pH 7.24. 20 kg ha^{-1} N, P at four levels 0, 30, 30+PSB & 45 kg ha^{-1} P and 30 kg ha^{-1} K to both the crops were applied through urea, single super phosphate and murate of potash, respectively. Half of nitrogen and total dose of phosphorus and potash were broadcasted as basal. While remaining half of nitrogen was top dressed at 15 days after sowing. An attempt was made to keep crop free of weeds, insects, pests and diseases through recommended agronomic practices. During the course of investigation growth parameters were recorded from the sampling strip of 0.5 meter, on either side adjoining to the border strip. The crops were harvested at their physiological maturity.

The experimental data were tabulated and statistically analyzed by following the procedure for a split plot design as described by **Gomez and Gomez (1984).**

Results and discussion

Results on growth and yield attributes of chickpea and coriander are presented in Table 1. Among the cropping pattern, sole chickpea recorded significantly higher values of growth and yield contributing characters of chickpea (pooled mean of 2013-14 and 2014-15) viz., nodule numbers at 60 days (16.35), nodule numbers at 90 days (10.33), nodule dry weight at 60 days (106.22 g) nodule dry weight at 90 days (735.0 g), plant dry weight at 60 days (1.52 g), plant dry weight at 90 days (8.98 g), grains per pod (1.5 g) and 1000 grain weight (222.5

Table 1. Effect of cropping patterns on yield attributes of chickpea (Pooled mean of 2013-14 and 2014-15).

Intercropping Pattern	Nodule Number/Plant at 60 days	Nodule Dry Weight/Plant at 60 days (gm)	Nodule Number/Plant at 90 days	Nodule Dry Weight/Plant at 90 days (gm)	Plant Dry Weight/Plant at 60 days (gm)	Plant Dry Weight/Plant at 90 days (gm)
Chickpea Sole	16.35	106.22	10.32	735.00	1.515	8.97
Coriander Sole	-	-	-	-	-	-
Chickpea + Coriander (3:1)	15.13	95.21	9.21	507.44	1.296	7.17
Chickpea + Coriander (4:2)	15.51	103.47	9.52	636.12	1.404	8.21
SEm±	0.219	1.238	0.11	3.41	0.005	0.086
CD (P=0.05)	0.883	4.993	0.43	13.74	0.021	0.346

Table 2. Effect of cropping patterns on yield of chickpea (Pooled mean of 2013-14 and 2014-15).

Intercropping Pattern	Chickpea				
	Grain per Pod	1000 Grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})
Chickpea Sole	1.50	222.58	2447.75	4282.12	6729.24
Coriander Sole	-	-	-	-	-
Chickpea + Coriander (3:1)	1.29	218.00	2212.24	3226.43	5439.45
Chickpea + Coriander (4:2)	1.50	214.58	2367.50	3766.62	6133.50
SEm±	0.132	0.407	12.5	131.5	141.5
CD (P=0.05)	NS	1.640	51.0	531	573.5

g) than other cropping patterns. It was due to no or less competition of main crop chickpea with intercrop coriander. Similar findings were reported by **Singh *et al.* (1998).**

Whereas grain straw ratio of chickpea intercropping with coriander in 4:2 were significantly more (0.71) than sole chickpea and chickpea intercropping with coriander in 3:1 cropping pattern ratio and harvest index of chickpea intercropping with coriander in 3:1 were significantly more (41.21%) than sole chickpea and chickpea intercropping with coriander in 3:1 cropping pattern ratio.

Biological, grain and straw yield of sole chickpea grown in 2013-14 and 2014-15 were significantly more (6730.37 kg ha^{-1}, 4282.0 kg ha^{-1} and 1203.46 kg ha^{-1}, respectively) than chickpea intercropping with coriander in 3:1 and 4:2 cropping pattern ratio. The findings shows that there was more yields of chickpea as sole crop there is difference among the crops as the intercropping was practiced in replacement series. **Tanwar *et. al.* (2011)** and **Upadhyay *et. al.* (2012)** has also expressed similar findings in their studies. Also was primarily due to higher plant population per unit area in sole chickpea. However, yield of chickpea on unit area basis might have increased as yield attributes were found better under intercropping systems as compared to sole chickpea. These findings are in close conformity with those of **Tiwari *et al.* (2002),** and similar results have also been reported by **Kumar *et al.* (2006), Tripathi and Srivastava (2006)** and **Mehta *et al.* (2010).** The sole cropping could simply be attributed as the reason of the highest yield by crop covering the entire area.

Among the cropping pattern, sole coriander recorded significantly higher values of growth and yield contributing characters of coriander (pooled mean of 2013-14 and 2014-15). Grain straw ratio and harvest index of sole coriander were significantly more (0.75 and 42.86, respectively) than chickpea intercropping with coriander in 3:1 and 4:2 cropping pattern ratio. Biological, grain and straw yield of sole coriander grown in 2013-14 and 2014-15 were significantly more (3103.99 kg ha^{-1}, 1768.03 kg ha^{-1} and 1335.96 kg ha^{-1}, respectively) than chickpea intercropping with coriander in 3:1 and 4:2 cropping pattern ratio. This was primarily due to higher plant population per unit area although yield of coriander on unit area basis might have increased as yield attributes were found better under intercropping systems. These findings are in close conformity with those of **Wasu *et al.* (2013)** and **Yadav *et al.* (2014).**

From the above findings, it can be concluded that the sole chickpea were produce more grain, straw and biological yield were in comparison to chickpea intercropping with coriander in 3:1 and 4:2 cropping pattern ratio.

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