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Evaluation of growth and seed yield of chickpea (*Cicer arietinum* L.)

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ABSTRACT

The field experiment was conducted during *rabi* 2020 at Zonal Agricultural Research Station, Mandya to study the impact of intercropping and nutrient dose on chickpea (*Cicer arietinum* L.) growth and seed yield. The results revealed the significant differences for growth and yield parameters of chickpea due to intercropping systems and fertilizer doses. A sole grown chickpea showed significantly higher plant height at harvest (35.73cm), number of pods per plant (42.02), hundred seed weight (23.20 g) and seed yield of chickpea (1733 kg/ha) compared to intercropping of chickpea with sorghum, safflower or linseed. Whereas, among fertilizer doses, application of 150 per cent recommended dose of fertilizer (RDF) produced noticeably taller plants at harvest (35.51 cm), number of pods (38.38), hundred seed weight (22.53 g) and seed yield of chickpea (1343 kg/ha) compared to other fertilizer doses. Therefore, sole cropping of chickpea with 150 per cent RDF could be recommended for certified seed production programme.

Introduction

The chickpea (*Cicer arietinum* L.), a crucial cool-season legume, is cultivated on 13.73 million hectares and produces an average yield of 982.1 kg/ha, ranking it as the third-most significant pulse in the world (Anon, 2019). India produces the most chickpeas worldwide, accounting for around 68 per cent of total production and 9.62 million hectares are used for cultivation, with an output of 974 kg/ha (Anon, 2019). Intercropping is the technique of growing two or more crops simultaneously in the same area. The most common benefit of intercropping is the ability to produce more yield on a given plot of land while using the natural resources more effectively by combining crops with different rooting abilities, canopy structures, heights, and nutrient requirements based on how well the component crops utilize their complementary growth resources. The fertilizers, which can be used to regulate the combined demand of both crops, may boost the efficiency of nutrients. Moreover, legumes can be intercropped to increase soil fertility through biological nitrogen fixation, soil conservation through increased ground cover over sole cropping, and insurance against crop failure or unstable market prices for a given commodity, particularly in regions vulnerable to extreme weather conditions like frost, drought, and flood. As a result, it provides more financial security than sole cropping, making the technique especially advantageous for labor-intensive small farms. Due to industrialization and urbanization the cultivable agriculture land is decreasing day by day and big size farmers are becoming small and marginal. Hence, in order to sustain the livelihood of each and every individual family they need to double their farm income within the available limited land holding with them. Hence, in order to address this problem, intercropping is one of the way where in the farmers can grow two crops within the same piece of land which differ in their root length, depth and with different durations which will not affect each other thereby they can get returns from both the crops and can double their farm

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income. In light of this, the current study was conducted to determine the impact of intercropping system and nutrient dosage on chickpea growth and seed yield.

Material and Methods

In *rabi* 2020, the field experiment was carried out at the Zonal Agricultural Research Station, Seed Unit, Mandya. The experiment was laid out in Two Factorial Randomized Complete Block Design with three replications. The trial included three different fertilizer doses of 100, 125 and 150 per cent recommended doses of fertilizers and four cropping systems, including solitary chickpea, chickpea + sorghum (4:2), chickpea + safflower (4:2), and chickpea + linseed (4:2). Before planting, chickpea seeds were treated with rhizobium and phosphate-solubilizing bacteria. The treated chickpea seeds and intercrop seeds were sown at a 4:2 row ratio in 3-5 cm deep soil, with a 30 cm row spacing and 10 cm between plants. Observations on its growth and yield attributes were recorded on five randomly selected plants from each plot (ISTA, 2015).

Results and Discussion

Plant height (cm)

Plant height of chickpea was significantly influenced by intercropping systems throughout its growth period (Table 1). Significantly higher plant height (23.34, 33.21 and 35.73 cm) was recorded in the sole crop of chickpea (C_1) at 30, 60 DAS and at harvest, respectively. However, it was found to be on par with chickpea + linseed (C_4) intercropping system but considerably reduced plant height of chickpea was observed in the intercropping system of chickpea and safflower (C_3) at 30, 60 DAS and at harvest (22.01, 31.54 and 33.95 cm, respectively).Similarly, a significant impact of fertilizer levels on plant height of chickpea was observed throughout the crop growing period. Application of 150 per cent recommended dose of fertilizers (F_3) showed highest plant height of chickpea (23.31, 32.88 and 35.51 cm) at 30, 60 DAS and at harvest, respectively which was statistically equivalent to the 125 per cent prescribed fertilizer dose (F_2). While, a considerable reduced plant height of chickpea was observed due to application of 100 per cent RDF (F_1) at 30, 60 DAS and at harvest (21.84, 31.72 and 34.02 cm, respectively). However, interaction between intercropping systems and levels of fertilizer application on plant height of chickpea was statistically non-significant.

Number of branches per plant

The number of branches per plant of chickpea differed significantly due to intercropping systems and levels of fertilizers application at advanced stage of crop growth (Table 2). A sole crop of chickpea (C_1) recorded significantly maximum number of branches per plant (10.24). However, it was found to be on par with chickpea + linseed (C_1) intercropping system (10.03). While, the significantly minimum number of branches per plant was noticed in chickpea + safflower (C_3) intercropping system (8.86).Among different fertilizer levels, the number of branches per plant significantly increased in 150 per cent RDF (10.00) followed by 125 per cent RDF (9.59). While, the significantly decreased number of branches per plant was noticed due to application of 100 per cent RDF (9.24). Interaction effect between intercropping systems and levels of fertilizer showed non-significant effect on number of branches per plant.

Number of pods per plant

Number of pods per plant observed in chickpea crop differed significantly due to intercropping systems (Table 2). In a single grown crop of chickpea (C_1), a significantly more number of pods per plant was observed (42.02) and significantly less numbers of pods per plant was recorded in chickpea + safflower (C_3) intercropping system (33.00).The amount of fertilizers had a substantial impact on the number of pods produced per plant in the chickpea intercropping systems. The number of pods per plant was found to be larger in 150 per cent RDF (38.38), and it was compared to 125 per cent RDF (37.47). The intercropping strategies and fertilizers levels exhibited a non-significant interaction effect on the number of pods produced per plant.

Seed yield per plant (g)

The variation in seed yield of chickpea per plant was significantly influenced by intercropping systems (Table 2). The sole crop of chickpea (C_1) recorded significantly higher seed yield per plant (10.23 g) over other intercropping systems. Lower seed yield per plant was recorded in chickpea + safflower (C_3) intercropping system (8.25 g).

Table 1: Effect of intercropping and fertilizer dose on plant height at different growth stages of chickpea

Treatments	Plant height (cm)		
	30DAS	60DAS	At harvest
Factor A: Intercrops (C)			
C_1- Sole chickpea	23.34	33.21	35.73
C_2- Chickpea+sorghum	22.49	32.02	34.57
C_3- Chickpea+safflower	22.01	31.54	33.95
C_4- Chickpea+linseed	22.65	32.24	34.73
S.Em±	0.27	0.37	0.39
CD at 5%	0.80	1.07	1.13
Factor B: Fertilizer dose (F)			
F_1- 100% RDF	21.94	31.72	34.02
F_2- 125% RDF	22.63	32.15	34.71
F_3- 150% RDF	23.31	32.88	35.51
S.Em±	0.24	0.32	0.34
CD at 5%	0.69	0.93	0.98
Interaction (C X F)			
C_1F_1	22.83	33.38	34.91
C_1F_2	23.10	32.63	35.18
C_1F_3	24.08	33.60	37.09
C_2F_1	21.53	31.06	33.61
C_2F_2	22.56	32.09	34.64
C_2F_3	23.28	32.90	35.46
C_3F_1	21.24	30.77	33.32
C_3F_2	22.07	31.59	34.15
C_3F_3	22.73	32.26	34.39
C_4F_1	22.14	31.66	34.22
C_4F_2	22.77	32.30	34.85
C_4F_3	23.04	32.77	35.12
S.Em±	0.47	0.63	0.67
CD at 5%	NS	NS	NS

Among different levels of fertilizer dose, the seed yield of chickpea per plant was significantly higher in 150 per cent RDF (9.10 g) followed by125 per cent RDF (8.98 g). The interaction between amounts of fertilizers and the intercropping systems had no appreciable impact on the number of seeds produced per plant.

Hundred seed weight (g)

The hundred seed weight of chickpea was assorted due to intercropping systems (Table 2). Significantly higher hundred seed weight of chickpea (23.20 g) was recorded in sole crop of chickpea (C_1). However, it was on par with chickpea + linseed (C_4) intercropping system (22.32 g). Significantly lowest seed weight of chickpea was recorded in chickpea + safflower (C_3) intercropping system (20.62 g).

Fertilizer levels showed significant effect on hundred seed weight of chickpea in intercropping systems. The hundred seed weight of chickpea was higher in 150 per cent RDF (22.53 g) and it was discovered to be equivalent to 125 percent RDF (21.74 g). Intercropping systems and fertilizers levels interaction had no discernible impact on the weight of chickpea seeds per hundred.

Seed yield per hectare (kg/ha)

The variation in the seed yield of chickpea per hectare was significantly influenced by intercropping systems (Table 2). The sole grown

Table 2: Effect of intercropping and fertilizer dose on number of branches per plant and seed yield attributes of chickpea

Treatments	No. branches per plant	No. of pods per plant	Seed yield (g/plant)	100 seed weight (g)	Seed yield (kg/ha)
Factor A: Intercrops (C)					
C_1- Sole chickpea	10.24	42.02	10.23	23.20	1733
C_2- Chickpea+sorghum	9.32	35.42	8.42	21.41	1090
C_3- Chickpea+safflower	8.86	33.00	8.25	20.62	952
C_4- Chickpea+linseed	10.03	39.69	9.04	22.32	1395
S.Em±	0.24	0.41	0.07	0.34	31
CD at 5%	0.69	1.20	0.20	1.00	92
Factor B: Fertilizer dose (F)					
F_1- 100% RDF	9.24	36.75	8.87	21.39	1241
F_2- 125% RDF	9.59	37.47	8.98	21.74	1294
F_3- 150% RDF	10.00	38.38	9.10	22.53	1343
S.Em±	0.20	0.35	0.06	0.29	27
CD at 5%	0.60	1.04	0.17	0.86	80
Interaction (C X F)					
C_1F_1	9.92	41.27	10.14	22.87	1684
C_1F_2	10.15	41.93	10.24	23.20	1733
C_1F_3	10.64	42.87	10.31	23.53	1781
C_2F_1	8.94	35.00	8.37	20.79	1007
C_2F_2	9.27	35.40	8.42	21.44	1098
C_2F_3	9.74	35.87	8.47	22.02	1164
C_3F_1	8.35	32.07	8.18	20.07	927
C_3F_2	8.93	33.07	8.26	20.30	946
C_3F_3	9.31	33.87	8.30	20.82	983
C_4F_1	9.75	38.67	8.79	21.49	1346
C_4F_2	10.01	39.47	9.00	22.02	1398
C_4F_3	10.33	40.93	9.32	23.09	1442
S.Em±	0.41	0.71	0.12	0.59	55
CD at 5%	NS	NS	NS	NS	NS

chickpea crop (C_1) gave significantly higher seed yield per hectare (1733 kg/ha) over other intercropping systems. Lower seed yield per hectare was recorded in chickpea + safflower (C_3) intercropping system (952 kg/ha). Among different levels of fertilizer dose, the seed yield of chickpea per hectare was significantly higher in 150 per cent RDF (1343 kg/ha) and also close result was noticed 125 per cent RDF (1294 kg/ha). The seed yield per hectare of chickpea crop was not significantly affected by the interaction impact of the intercropping systems and fertilizers levels. Crop growth performance is generally judged by plant height and number of branches produced which are governed by genotypic characters, nutritional and environmental factors. Intercropping systems had significantly affected the plant height and number of branches of chickpea. Sole crop of chickpea had taller plants and higher branches in comparison to intercropping systems tested that may be due to shading effect of intercrops on chickpea and also due to competitive nature which might have exploited light, water and nutrients for its own growth. These results were in accordance with reports made by Promod *et al.* (2018) in chickpea + mustard intercropping system, Dharmendra *et al.* (2018) in chickpea + linseed intercropping system and Nandhini *et al.* (2015) in pigeonpea + greengram intercropping system.The number of pods per plant, seed yield per plant, and test weight are important primary yield components, which were significantly influenced by intercropping systems and fertilizers levels. However, reduction of yield characteristics has been recorded in intercropping system compared to sole crop of chickpea. The results indicated the above were in accordance with reports made by Anitha *et al.* (2015) that reduction of yield attributes might be due to intensified interspecific competition for light and utilization of available resources offered by intercrops, resulting in etiolated growth and poor pod setting. Similar results were in accordance with reports made by Azar *et al.* (2013)

in chickpea + barley intercropping system, Manpreet *et al.* (2016) and Tanwar *et al.* (2011) in chickpea based cropping systems. Seed yield is the ultimate outcome of various physiological, biochemical and phenological functions occurring in the plant kingdom. Seed yield of chickpea significantly influenced by intercropping systems and fertilizer doses. It might be due to more number of plant population in the sole system than intercropping and also due to the increased rates of photosynthetic activity and the transfer of photosynthate to various plant sections caused by fertilizer application to intercrops. Kalaghatagi *et al.* (2017) in chickpea + linseed intercropping system, Dhadge *et al.* (2014) and Jani *et al.* (2015) in chickpea based cropping system reported similar results.

Conclusion

From the aforementioned findings, Chickpea crop grown as a sole (C_1) given higher seed yield over intercropping system. While for different doses of fertilizers, application of 150 per cent RDF found to be best.

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Conflict of interest

The authors declare that they have no conflict of interest.

References

Anitha, M., Swami, D. V., & Salomi Suneetha, D. R. (2015). Seed yield and quality of fenugreek (*Trigonella foenum-graecum* L.) cv. Lam Methi-2 as influenced by integrated nutrient management. *The Bioscan*, *10*(1), 103-106.

Anonymous, Food and Agriculture organization, 2019. https://www.fao.org/home/en

Azar. R. M., Javanmard, A., Shekari, F., Pourmohammad, A. & Esfandyari, E. (2013). Evaluation of yield and yield components chickpea (*Cicer arietinum* L.) in intercropping with spring barley (*Hordeum vulgare* L.). *Cercetari Agronomice in Moldova, 46*(4), 75-85.

Dharmendra, M., Chandra, B., Anil, S., Singh, V. K., & Navneet, P. (2018). Effect of planting patterns and fertility levels in chickpea and linseed intercropping in Tarai region of Uttarakhand, India. *International Journal of Current Microbiology and Applied. Science, 7*(08), 1957-1961.

Dhadge, S. M., Satpute, N. R., Kathmale, D. K., Patil, S. V., Ravindra Chary, G., Srinivasa Rao, Jadhav, J. D., & Kadam, J. R. (2014). A study on sorghum (*Sorghum bicolour* L.) + chickpea (*Cicer arietinum*) intercropping systems with varying row proportions on a semiarid vertisol. *Indian Journal of Dryland Agricultural Research and Development, 29*(2), 34-40.

ISTA, International rules for seed testing, 2015, Pp 135-147.

Jani, A. H. A., Hossain, M. A., Karim, M. M., & Hasan, A. K. (2015). Performance of maize–lentil/chickpea intercropping as influenced by row arrangement. *International Journal of Sustainable Crop Production, 10*(3), 1-7.

Kalaghatagi, S, B., Guggari, A. K., Kambrekar, D. N., & Kadasiddappa, M. (2017). Performance of linseed based intercropping systems in different row ratios under semi-arid region of Karnataka. *Indian Journal of Dryland Agricultural Research and Development, 32*(1), 26-31.

Manpreet, Kour, Thakur, N. P., Pursushottam Kumar & Charak, A. S. (2016). Productivity and profitability of maize (*Zea mays*) as influenced by intercropping of rajmash (*Phaseolus vulgaris*) and nutrient management techniques under sub alpine conditions of Jammu, India. *Legume Research, 39*(6), 970-975.

Nandhini, D. U., Vimalendran, L., Latha, K. R., Sangamithra, S., & Kalaiyarasan, V. (2015). A review on biological advantages of pigeonpea intercropping influenced by different cropping geometries. *International Journal of Agricultural Science, 5*(3), 103-112.

Promod, K. Y., Satya Prakash Singh, Dohare, A. P. S., & Shailendra Singh, (2018). Production, quality and profitability of chickpea (*Cicer arietinum*) + Indian mustard (*Brassica juncea*) intercropping as influenced by phosphorus fertilization in rain fed condition. *International Journal of Current Microbiology and Applied. Science, 7*, 3117-3121.

Tanwar, S. P. S., Rokadia, P., & Singh, A. K. (2011). Effect of row ratio and fertility levels on the performance of chickpea (*Cicer arietinum*) and linseed (*Linum usitatissimum*) intercropping system under rainfed conditions. *Indian Journal of Agronomy, 56*(3), 87-92.