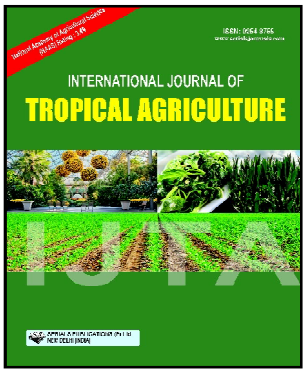

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Effect of planting geometry on seed yield and quality of kabuli chickpea (*Cicer arietinum* L.) genotype

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Abstract: Chickpea is an important rabi season pulse crop, mostly grown in rain fed situation, among two types desi and kabuli chickpea are bold white seeded and its productivity is influenced by planting density and genotypes.

Hence the field and laboratory experiment was carried out during *rabi* season 2014-2015 and 2015-2016 to study the effect of different planting geometry on seed yield and quality of kabuli chickpea MNK-1. Among the different planting geometry studied, the highest number of pods/plant (32.66), seed yield/ plant (17.15g) were recorded in planting geometry of 45x20 cm over other planting geometry but the total seed yield/ha was recorded highest with the planting geometry of 30x10 cm due to more number of plants per area compared to other. Hence for kabuli chickpea/MNK-1 seed production, 30x10 cm planting geometry is found better.

Key words: Kabuli Chickpea, planting geometry**,** seed yield and seed quality.

Chickpea (*Cicer arietinum* L.) is a rainfed, low inputs, winter leguminous crop used in various foods in several developing countries, particularly in India as a source of dietary protein. It is a rich source of highly digestible dietary protein (17- 21 per cent), carbohydrate (61.5 per cent) and fat (4.5 per cent). It is also rich in calcium, iron, niacin, vitamin B and vitamin C. The major chickpea producing countries in Asia are India (65%), Pakistan (7.5%) and Turkey (6.5%). India grows chickpea on 8.56 million ha and producing 7.65 million tonnes [1] and having productivity of 858 kg/ha. There are two types of chickpea *viz* desi and kabuli, grown in the world recognized visually by seed coat colour and seed size. The desi types is characterized by small seed size and thick seed coat with pale to dark brown in colour, where as kabuli type is large seed size cream in colour with thick seed coat. There are several reasons of

low productivity in pulses. However, the factors like improved varieties and method of establishment may prove beneficial to enhance the productivity of chickpea. The planting geometry and value of seed is one of the key factors for proper plant establishment and performance, particularly under moisture stress conditions. Several workers have reported the positive response of seed yield in chickpea to planting geometry under varied plant type. Chickpea seed yield can be increased by providing suitable planting geometry [2]. So there is need to adopt a suitable management practices like a proper planting geometry and to develop high yielding genotypes.

MATERIAL AND METHODS

The field and lab experiment were carried out during *rabi* season in 2014-2015 to 2015-2016, to study the effect of different planting geometry on seed yield and quality of kabuli chickpea MNK -1 (*Cicer arietinum* L.) genotype.

Six planting geometry of P1-30x10 cm, P2-45x10 cm, P3-30x10 cm, P4-45x10 cm, P5-30x10 cm and P6-45x10 were taken for the study. Treatments were replicated four times in RCBD design. The seed plot was raised by following recommended package of practices for chickpea cultivation under irrigated condition. All the data on growth, seed and yield parameters were recorded and statistically analyzed. The observations on various seed quality parameters *viz*., seed germination (%) [3], seedling vigour index were recorded as per the methods and procedures described by [4].

RESULTS AND DISCUSSION

The performance of planting geometry is governed by a number of growth factor which individually are in combination determines the yield potentiality. Thus, identification of all such favourable yield and growth components and their integration in planting geometry can lead to its better performance over other.

Different planting geometry exhibited significant influence on the growth and seed yield and quality parameters of chickpea. Planting geometry exhibited significant influence on growth parameters. Plant height at harvesting stage was high in 30x10cm (50.68, 46.44) followed by 30x15cm (50.40, 45.20) respectively in 2015 and 2016 (Table 1). Similar results were observed under pooled analysis in 30x10cm (48.56 cm) followed by 30x15cm (47.38cm). The mean number of pods per plant was highest in 45x20cm (33.55 & 31.8 cm) followed by 45x15cm (32.60 & 31.60 cm) (Table 1) and in pooled analysis also number of pods per plant highest in 45x20 cm (32.66 cm) followed by 45x10cm (31.79 cm). Similarly [5,6] also recorded significantly higher pod yield per plant in row spacing at 40cm when compared to 20 and 30 cm.

Increase in planting geometry enhanced the individual plant performance. The kabuli chickpea sown at wider spacing recorded significantly higher number of pods per plant, seed yield per plant as compared to closer spacing. The number of pods per plant recorded at wider spacing was higher by six per cent when compared to closer spacing as reported by [7]. The better performance of individual plant with respect to these yield attributes at wider spacing was due to superiority of the growth attributes due to efficient utilization of moisture, nutrient and solar energy under lower degree of plant population. [8] also recorded significantly higher pods per plant and number of seeds per plant in row spacing of 40 cm when compared to other spacing.

Finally highest seed yield (kg/ha) was recorded in the planting geometry of 30x10cm (1729.60 kg/ha), which is on par with 30x15 cm (1602.29kg/ha) and least in the 45x20cm (1222.5 kg/ha) due to highest number of plants per unit area (Table 2). This result is in accordance with the [5]. Increased seed yield in 45x20 cm was due to increased performance by the individual plant and less

competition for nutrients, water and sunlight etc. similar results were reported by [9].

Significantly higher yield per unit plant obtained at spacing of 30×10 cm may be attributed to significant difference in the dry matter production at different stages of crop growth and its apportioning into stem, leaves and reproductive parts. The kabuli chickpea at wider spacing recoded significantly higher dry matter per plant as compared to the dry matter produced per plant at closer spacing at all growth stages. These results are in agreement with the finding of [10] who observed reduction in dry matter production per plant with an increase in plant population per unit area. The highest dry matter production per plant at wider spacing may be attributed to significantly higher number of leaves, number of branches, and in turn higher dry matter accumulation in leaves, stem and reproductive parts.

100 seed weight was highest in 45x20cm in both the years and in pooled analysis also 45x20cm (54.5gm) (Table 2) recorded highest 100 seed weight because wider spacing provides good condition for growth of seeds and there is no competition for resources hence the seeds were bold and give good seed weight. 100 seed weight and No. of pods per plant was highest in 45x20cm followed by 45x15cm hence seed yield per plant was also recorded maximum in 45x20cm. Similar results were observed by [11]. Whereas seed yield kg/ha was highest in 30x10cm followed by 30x15cm in both the years. And similar results were observed under pooled analysis in 30x10cm (1729.60kg/ha) followed by 30x15cm (1602.29 kg/ha).

Seed quality parameters were influenced by different planting geometry in Kabuli chickpea and non significant difference was observed in germination per cent (Table 3). Significantly higher seed germination was recorded in 2015 and numerically highest during 2016 (90.00 and 89.50) and pooled (89.38) in 45x20cm followed by 45x15cm. And significantly higher seedling vigour index-I (2403) and seedling vigour index-II (6748) was observed in 45x20cm followed by 45x15cm but difference compared to other methods was meager.

CONCLUSION

The study indicated that the planting geometry of 30x10cm is better for obtaining highest seed yield at acceptable seed quality parameters even though there is improvement of seed vigour due to wider spacing.

Table 1
Effect of suitable planting geometry on seed yield and quality of kabuli chickpea cv. MNK-1

Treatments	*Plant height at harvesting stage (cm)*			*No. of pods/ plant*			*Seed yield/ plant (gm)*		
	2015	*2016*	*Pooled*	*2015*	*2016*	*Pooled*	*2015*	*2016*	*Pooled*
$S_{1\text{-}30x\ 10\ cm}$	50.68	46.44	48.56	27.78	26.2	26.99	10.60	11.45	11.06
$S_{2\text{-}30x\ 15\ cm}$	50.40	45.20	47.38	31.38	29.4	31.00	13.08	12.09	12.22
$S_{3\text{-}30x\ 20\ cm}$	49.25	44.36	47.22	31.75	30.1	31.36	15.70	12.17	12.62
$S_{4\text{-}45x10cm}$	48.60	43.90	45.85	32.03	30.3	30.38	12.35	14.27	14.99
$S_{5\text{-}45x15cm}$	47.80	42.36	45.48	32.60	31.6	31.79	16.53	16.17	16.35
$S_{6\text{-}45x20cm}$	47.25	42.01	44.63	33.55	31.8	32.66	17.88	16.42	17.15
Mean	49.00	44.04	46.52	31.51	29.9	30.70	14.37	13.76	14.06
SEm±	0.79	1.40	0.91	0.56	0.72	0.72	0.54	0.78	0.52
CD (0.05)	2.39	NS	NS	1.68	2.16	1.25	1.63	2.34	1.57

Table 2
Effect of suitable planting geometry on seed yield and quality of kabuli chickpea cv. MNK-1

Treatments	*100 seed weight(gm)*			*Seed yield/ ha (kg)*		
	2015	*2016*	*Pooled*	*2015*	*2016*	*Pooled*
$S_{1\text{-}30x\ 10\ cm}$	48.75	45.55	47.15	1886.57	1572.63	1729.60
$S_{2\text{-}30x\ 15\ cm}$	52.38	47.77	50.07	1831.60	1372.97	1602.29
$S_{3\text{-}30x\ 20\ cm}$	53.15	47.78	51.10	1634.84	1183.45	1409.14
$S_{4\text{-}45x10cm}$	55.00	49.06	51.63	1533.56	1406.25	1469.91
$S_{5\text{-}45x15cm}$	55.10	52.17	53.58	1403.36	1171.88	1287.62
$S_{6\text{-}45x20cm}$	55.48	53.00	54.05	1316.55	1128.47	1222.51
Mean	53.31	49.22	51.26	1601.08	1305.94	1453.51
SEm±	0.61	0.97	0.54	102.76	64.46	63.78
CD (0.05)	1.83	3.60	1.62	309.75	194.29	192.26

Table 3
Effect of suitable planting geometry on quality parameters of kabuli chickpea cv. MNK-1

Treatments	*Germination (%)*			*Seedling vigour index I*			*Seedling vigour index II*		
	2015	*2016*	*Pooled*	*2015*	*2016*	*Pooled*	*2015*	*2016*	*Pooled*
$S_{1\text{-}30x\ 10\ cm}$	88.00	87.00	86.63	2133	2074.	2103	6392	6385	6388
$S_{2\text{-}30x\ 15\ cm}$	88.00	87.25	87.63	2358	2187	2273	6608	6575	6591
$S_{3\text{-}30x\ 20\ cm}$	88.00	87.75	88.25	2225	2206.	2216	6591	6536	6564
$S_{4\text{-}45x10cm}$	88.00	88.00	87.75	2286	2173	2229	6536	6552	6544
$S_{5\text{-}45x15cm}$	89.00	87.25	89.25	2399	2340.	2369	6539	6786	6663
$S_{6\text{-}45x20cm}$	90.00	89.50	89.38	2498	2309	2403	6876	6620	6748
Mean	88.50	87.79	88.15	2316.5	2215	2265	6590	6575	6583
SEm±	0.74	1.15	0.68	43.65	62.65	31.91	85.21	129.49	86.04
CD (0.05)	2.31	NS	NS	129.68	186.13	94.80	253.19	3847.44	255.61

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