

Effect of Chickpea Stunt Disease on Yield Attributing Trait and Yield of chickpea

Saurav Kumar and Ramesh Nath Gupta*

Department of Plant Pathology, BAC, Bihar Agricultural University, Sabour (Bihar), India.

(Corresponding author: Ramesh Nath Gupta*)

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ABSTRACT: Chickpea is an important Rabi pulse crop of India. Chickpea stunt disease (CpSd) incited by bean (pea) leaf roll virus and transmitted by aphid is an important disease of chickpea. Diseased plants are easily spotted in the field by their yellow, orange or brown discoloration, shortened internodes and stunted growth. In India, yield loss by chickpeas stunt is 80-95 per cent. In Bihar, chickpea stunt disease is an economical and emerging problem in cultivation of chickpea. An experiment was conducted to identify suitable date of sowing with least incidence of chickpea stunt disease. CpSd adversely affected both plant height and yield in all test seven varieties in three different date of sowing. Effect of different dates of sowing on CpSd incidence was found maximum during early sowing (1st November) followed by mid sowing (15th November) and late sowing (30th November). The response of stunt disease against test seven cultivars in all three dates of sowing was assessed. Observations of plant height and yield per plant of both healthy and diseased plant were taken into consideration. Maximum reduction of plant height was recorded in early date of sowing in variety JG315 and minimum in GCP105 whereas other varieties showed intermediate reduction. Similarly maximum yield reduction in early sown was recorded in JG315 followed by BG256 and minimum in GCP 105. During mid date of sowing maximum reduction of yield was observed in JG315 and minimum in GCP105. Similarly maximum yield reduction was found in variety JG315 and minimum in GCP105. Incidence of chickpea stunt was recorded maximum in early sown followed by mid sown and minimum in late sown condition of chickpea. Among varieties minimum stunt disease incidence was observed in GCP105 and maximum in JG315. Chickpea stunt disease was found minimum in variety GCP105 during late sown crop condition.

Keywords: chickpea, yield, yield attributes, stunt disease.

INTRODUCTION

Chickpea is a cool season legume crop grown worldwide as a food crop. Seed is main edible and nutritious part of the plant. It ranks third (FAO, 2008) among the food legumes after beans and pea. Major chickpea-producing countries are: India (65% of annual production), Pakistan (10%), Turkey (7%), Iran (3%), Myanmar (2%), Mexico (1.5%) and Australia (1.5%) Chickpea is a cheap and important source of protein for those people who cannot afford animal protein or who are largely vegetarian. Furthermore, chickpea is also a good source of minerals (calcium, phosphorus, magnesium, zinc and iron), unsaturated fatty acids, fibre and β -carotene). Chickpea also plays an important role in maintaining soil fertility by fixing nitrogen at rates of up to 140 kg/ha/year (Flowers *et al.*, 2010). Therefore, this crop requires relatively low inputs of nitrogen as it derives 70% of its N through symbiotic N₂ fixation and benefits other cereal crops (Siddique *et al.*, 2005). In India, chickpea occupies area 9.93 million hectare and contributing 9.53 million tonnes to the national pulse basket with productivity 960 kg/ha during 2013-14. The major chickpea producing states are Madhya Pradesh,

Rajasthan, Andhra Pradesh, Maharashtra, Uttar Pradesh and Bihar. During this year in Bihar state chickpea area, production and productivity are 61.30 thousand ha, 86.50 tonnes and 1147 kg/ha respectively. India is also the largest consumer of chickpea in the world. As a result, the country occupied second place in world despite contributing for about 70% of world's total production. The area under chickpea is gradually declining day by day in the country. The major reasons are biotic and abiotic stresses prevalent in growing season of chickpea. Diseases are the most serious problems to chickpea productivity causing up to 100% losses. Though 67 fungi, 3 bacteria, 22 viruses and 80 nematodes are reported to adversely affect the growth and productivity of the crop (Singh *et al.*, 1999). The extents of yield losses in chickpea are due to wilt, root rot and stunt diseases. About 50 pathogens including viruses and 54 insect pests have been reported on chickpeas from different parts of the world. Stunt disease of chickpea is an emerging problem of chickpea cultivation. Viral diseases often cause significant yield losses (Kumar *et al.*, 2008). Chickpea plants that become infected with CCDV at an early stage of development normally do not produce any pods. The above-described

symptoms are followed by rapid plant decline, and very few early infected plants survive. Kaiser and Danesh (1971) reported that in Iran BLRV caused 90-100% yield loss in chickpea when plants were aphid-inoculated. In chickpea naturally infected with chickpea stunt in India, Kotasthane and Gupta (1978) reported 80-95% yield reduction. This observation was based on natural incidence of chickpea stunt disease in chickpea fields. Consistent occurrence of chickpea wilt and stunt disease causes serious yield loss to the chickpea crop every year in all major chickpea growing areas of India (Malathi and Kanakala, 2017). Stunt disease was reported from several major chickpea growing areas in India: Haryana (Sangwan *et al.*, 1981); Karnataka (Pallavi *et al.*, 2012), UP, Maharashtra and Karnataka (Akram *et al.*, 2016).

MATERIALS AND METHODS

Present investigations were carried out at Pulse research area of Bihar Agricultural University, Sabour during Rabi 2015-16. The plot had a fairly uniform topography and the soil was deep well drained sandy loam. Recommended package of practices was followed to raise a good crop of chickpea. Varieties popularly grown in the region were evaluated for the response against the stunt disease. The present study was conducted to test the performance of cultivars against stunt disease. The field experiment was conducted in three different date of sowing at 15 days of interval *viz.*, 1st, 15th and 30th November, 2015. In each date of sowing, seven cultivars like, BG256, JG62, JG315, GCP105, PG186, JG14, BG372 were sown in RBD with 3 replication having plot

size 12.5 m² along with all agronomical package of practices.

Disease incidence (%) is calculated by using formula:

$$\text{Percent disease incidence} = \frac{\text{No. of plants infected}}{\text{Total no. of plants}} \times 100$$

RESULTS AND DISCUSSION

The reaction of stunt disease against all seven cultivars in each date of sowing was assessed. Observations like plant height and yield per plant of both healthy and diseased plant were taken into consideration. During early date of sowing infection of chickpea stunt virus showed reduction of plant height by 40.05 – 57.98 per cent which was found maximum in variety JG315 and minimum in GCP105 whereas, other varieties showed intermediate losses (Table 1). In mid date of sowing maximum CpSd incidence was observed maximum 39.10 per cent in variety JG315 followed by 29.29 per cent in BG256 and minimum 10.94 per cent in GCP105 (Table 2). Similarly, in late date of sowing stunt disease incidence was recorded 14.09 - 31.63 per cent and maximum CpSd incidence was observed 31.63 per cent in variety JG315 followed by 25.61 per cent in BG256, 19.21 per cent in JG14, 17.72 per cent in JG62, 14.23 per cent in BG372, 13.15 per cent in PG186 and minimum in 14.09 per cent in GCP105 (Table 3). The reduction of plant height was observed due to shortened internodes. Similar findings were also observed by Kanakala *et al.* (2013).

Table 1: Effect of CpSd on plant height in early sown condition of chickpea.

Sr. No.	Variety	Healthy plant	Diseased plant	Reduction (%)
1.	BG256	53.97	25.27	53.17
2.	JG62	47.73	23.13	51.53
3.	GCP105	39.20	23.50	40.05
4.	PG186	38.83	22.20	42.82
5.	JG315	37.77	15.87	57.98
6.	JG14	35.20	16.83	52.18
7.	BG372	38.00	20.43	46.23
	CD at 5%	4.74	4.15	
	CV (%)	6.42	11.11	

Table 2: Effect of CpSd on plant height in mid sown condition of chickpea.

Sr. No.	Variety	Healthy plant	Diseased plant	Reduction (%)
1.	BG256	36.50	19.17	47.47
2.	JG62	49.17	26.57	45.96
3.	GCP105	37.33	25.33	32.14
4.	PG186	36.33	22.33	38.53
5.	JG315	34.33	17.27	49.69
6.	JG14	45.17	24.20	46.42
7.	BG372	35.67	23.23	34.87
	CD at 5%	5.30	4.13	
	CV (%)	7.59	10.30	

Table 3: Effect of CpSd on plant height in late sown condition of chickpea.

Sr. No.	Variety	Healthy plant	Diseased plant	Reduction (%)
1.	BG256	42.83	25.60	40.22
2.	JG62	38.03	22.83	39.96
3.	GCP105	35.40	27.40	22.59
4.	PG186	33.53	24.80	26.03
5.	JG315	33.80	19.47	42.39
6.	JG14	32.40	19.43	40.03
7.	BG372	41.30	27.10	34.38
	CD at 5%	3.27	3.40	
	CV (%)	5.00	8.05	

Table 4: Effect of CpSd on yield/plant (g) in early sown condition of chickpea.

Sr. No.	Variety	Healthy plant	Diseased plant	Reduction (%)
1.	BG256	5.63	0.74	86.85
2.	JG62	6.70	0.94	85.97
3.	GCP105	7.70	1.69	78.05
4.	PG186	4.23	0.86	79.66
5.	JG315	3.77	0.44	88.32
6.	JG14	7.67	1.04	86.44
7.	BG372	4.43	0.90	79.68
	CD at 5%	0.79	0.45	
		7.77	27.21	

Table 5: Effect of CpSd on yield/plant (g) in mid sown condition of chickpea.

Sr. No.	Variety	Healthy plant	Diseased plant	Reduction (%)
1.	BG256	7.13	0.95	86.67
2.	JG62	5.23	0.98	81.26
3.	GCP105	8.13	1.85	77.24
4.	PG186	3.93	0.78	80.15
5.	JG315	4.13	0.53	87.16
6.	JG14	7.93	1.14	85.62
7.	BG372	5.03	0.97	80.71
	CD at 5%	0.40	0.97	
		3.84	0.38	

Table 6: Effect of CpSd on yield/plant (g) in late sown condition of chickpea.

Sr. No.	Variety	Healthy plant	Diseased plant	Reduction (%)
1.	BG256	5.37	0.99	81.56
2.	JG62	3.63	0.81	77.68
3.	GCP105	6.13	1.89	69.16
4.	PG186	6.10	1.39	77.21
5.	JG315	3.67	0.64	82.56
6.	JG14	6.13	1.18	80.75
7.	BG372	5.17	1.15	77.75
	CD at 5%	0.71	0.34	
		7.80	16.81	

Chickpea stunt disease adversely affected the yield. Reduction in yield per plant due to CpSd incidence was recorded 78.05 - 88.32 per cent in early date of sowing. It was observed maximum reduction 88.32 per cent in variety JG315 followed by 86.85 per cent in BG256, 86.44 per cent in JG14, 85.97 per cent in JG 62, 79.68 per cent in BG 372, 79.66 per cent in PG186 and minimum 78.05 per cent in GCP 105 (Table 4). During mid date of sowing reduction in yield per plant due to CpSd infection was ranged from 77.24 to 87.16 per cent (Table 5). Similarly during late date of sowing yield per plant due to CpSd infection was recorded 69.16- 82.56 per cent. It was observed maximum reduction 82.56 per cent in variety JG315 followed by 81.56 per cent in BG256, 80.75 per cent in JG14, 77.68 per cent in JG62, 77.65 per cent in BG372, 77.21 per cent in PG186 and

minimum 69.16 per cent in GCP105 (Table 6). In response to CpSd infection, the loss in yield was also confirmed by earlier workers *viz.*, Ayub *et al.* (1990); Horn *et al.* (1995) and observed yield loss 62.40 -99.81 per cent and 75 – 90 per cent, respectively. They observed when symptoms were already present at flowering stage and yield loss was 100 per cent. When disease appeared during pod filling stage yield loss was slightly lower than early stage infection but still 75-90 per cent. The most vulnerable cultivar, WR 315, which suffered 100% yield loss when infected before flowering. Present finding showed that maximum chickpea stunt disease incidence in variety JG315 and minimum in GCP105 in all three dates of sowing. Maximum stunt disease incidence and maximum reduction in yield trait and yield in early date of sowing

followed by mid date of sowing and least in late date of sowing. These findings were in conformity with the observation made by Saxena *et al.*, (1997). Darini and Azadvar (2016) also observed sowing date effect on Tomato Yellow Leaf Curl Virus.

CONCLUSIONS

Stunt disease of chickpea had adversely affected the yield traits and yield. It showed variable reaction during different dates of sowing on different cultivars. Minimum disease was noticed during late sown crop conditions followed by mid sown and maximum in late sown crop. Among test cultivar highest reduction in plant height and yield was observed in variety JG315 and lowest in GCP105 in all three different dates of sowing.

FUTURE SCOPE

Further investigation could focus on study of stunt disease incidence on other pulse crop. Molecular study and management strategies required for management of stunt disease.

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Conflict of Interest. None.

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