

Effect of Different Densities of *Cuscuta* on Varieties of Niger [*Guizotia abyssinica* (L. f.) Cass]

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ABSTRACT

Reduction in niger seed yield was minimum in cv. Ootacamund (63%) due to *Cuscuta* infestation. Niger height and per cent *Cuscuta* infestation were reduced with increasing densities of *Cuscuta*. A density of single plant of *Cuscuta* m² caused 100% infestation to niger in 80 days; however, it was lesser at lower densities (73.7 to 74.3%). There was a reduction in niger seed yield from 55 to 99.2% with increasing densities of *Cuscuta* (0.25-8 m⁻²).

INTRODUCTION

Niger (*Guizotia abyssinica* (L. f.) is an oilseed crop grown in an area of 5.42 lakhs ha. India is the largest producer and exporter of niger, which alongwith sesame contributed Rs. 595 crores to the national exchequer in 2000-01 and it was 2.1% of India's agricultural exports (Rao, 2002). It is cultivated in Andhra Pradesh, Madhya Pradesh, Orissa, Maharashtra, Bihar, Karnataka, Nagar Haveli and West Bengal states of India of which Madhya Pradesh has the largest area. *Cuscuta*, commonly known as Dodder, parasitizes number of economical crop plants, weeds and woody dicot plants (Kondap and Kumar, 1993). Among the six species in India, *Cuscuta chinensis* occurs in field crops. In 1973, it was found infesting niger largely in Koraput district of Orissa (Rath, 1975). Its infestation in niger causes stunted slow growth, inhibited branching, reduced number and size of flower heads and seeds per plant (Rath and Mohanty, 1986). It is widely distributed throughout niger growing regions and attacks critically on stem and leaves and reduces seed yield to an extent of 60-65% (Misra *et al.*, 1981). Crop cultivars tolerant to *Cuscuta* seem to be a logical method of reducing the infestation in endemic areas.

Therefore, two field experiments were conducted to know the competitiveness of different niger cultivars tolerant to *Cuscuta chinensis* and its density effect on niger.

MATERIALS AND METHODS

A field experiment was conducted during late **kharif** of 2003 at National Research Centre for Weed Science, Jabalpur to find out the damage caused by *C. chinensis* on niger (cv. JNC 6). The experiment consisting of 11 *Cuscuta* densities (0, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 7 and 8 plants m⁻²) was laid out in a randomized block design with three replications. *Cuscuta* plants were maintained in numbers according to the treatments, while removing all other weeds as and when they appeared.

Another field experiment was conducted during late **kharif** 2002 and 2003 to find out the relative tolerance of five niger cultivars to *C. chinensis*. This was laid out in a split plot design with three replications, with main plots comprising *Cuscuta*-free and *Cuscuta*-infested treatments and niger varieties in sub-plots. Observations on per cent reduction in niger population, niger plant height, percentage of niger plants infested with *Cuscuta* and *Cuscuta* seed yield were analysed in randomized block design, whereas crop seed yield in split plot design. The crop was sown in 1 x 1 m plots at a spacing of 25 cm. *Cuscuta* seeds after treatment with concentrated sulfuric acid were uniformly distributed (4 g plot⁻¹) in the experimental field in *Cuscuta* infestation treatments at the time of sowing. The yield of both niger and *Cuscuta* clean dry seeds was recorded after threshing and sun-drying.

Table 1. Effect of *Cuscuta chinensis* densities on plant height, infestation and seed yield of niger and *Cuscuta*

<i>Cuscuta</i> density (No. m ⁻²)	Niger height (cm)						Percentage of niger plants infested with <i>Cuscuta</i>						Per cent decrease in niger population	Seed yield of niger (g m ⁻²)	<i>Cuscuta</i>	
	40		60		80		40		60		80				Seed yield (g m ⁻²)	Seed No. ('000)
	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS	DAS				
0 (Control)	63.0	79.7	90.0	4.05 (0.0)	4.05 (0.0)	4.05 (0.0)	4.05 (0.0)	4.05 (0.0)	4.05 (0.0)	4.05 (0.0)	4.05 (0.0)	4.05 (0.0)	22.1	-	-	
0.25 (1 plant 4 m ⁻²)	52.7	73.7	80.7	41.2 (43.5)	64.4 (81.6)	73.7 (92.0)	41.2 (43.5)	64.4 (81.6)	73.7 (92.0)	20.2 (13.5)	10.6	69.1	89			
0.5 (1 plant 2 m ⁻²)	52.7	71.0	79.2	46.4 (52.4)	71.8 (90.2)	74.3 (92.6)	46.4 (52.4)	71.8 (90.2)	74.3 (92.6)	21.4 (14.1)	6.3	73.1	94			
1	30.0	55.3	65.3	65.3 (82.4)	81.5 (97.0)	85.4 (100)	65.3 (82.4)	81.5 (97.0)	85.4 (100)	42.7 (46.1)	3.1	70.6	91			
2	29.7	50.3	63.3	81.8 (97.9)	85.4 (100)	85.4 (100)	81.8 (97.9)	85.4 (100)	85.4 (100)	45.4 (50.7)	2.2	68.4	88			
3	29.0	50.0	60.3	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	49.1 (57.1)	1.2	66.5	85			
4	28.3	48.3	57.3	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	53.9 (61.9)	1.2	62.4	84			
5	28.0	46.3	51.3	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	54.9 (66.8)	0.67	62.0	80			
6	26.0	44.0	48.3	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	59.7 (74.5)	0.4	60.1	77			
7	25.3	43.7	45.0	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	64.2 (81.0)	0.23	42.2	54			
8	24.3	36.3	42.3	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	85.4 (100)	70.1 (88.4)	0.17	32.4	41			
LSD (P=0.05)	5.50	7.64	5.63	3.1	4.3	2.1	3.1	4.3	2.1	4.07	1.83	7.88	-	-		

Figures in parentheses are average per cent reduction and these values are transformed to $\text{Sin} \sqrt{X}$.

Table 2. Per cent reduction in niger height at 40 and 80 days of *Cuscuta*-infested to *Cuscuta*-free, per cent *Cuscuta* infestation at 75 days and seed yield of *Cuscuta* (g m⁻²)

Cultivars	Per cent reduction in niger height		Percentage of niger plants infested with <i>Cuscuta</i> at 75 DAS	<i>Cuscuta</i>	
	40 DAS	80 DAS		Seed yield (g m ⁻²)	Seed No. (in lakhs)
JNC 1	42.03 (44.8)	31.3 (27.0)	85.38 (100)	48.93	0.67
JNC 6	39.47 (40.4)	32.43 (28.8)	71.61 (90.0)	34.73	0.45
Ootacamund	30.73 (26.2)	25.33 (18.4)	60.56 (76.0)	19.4	0.25
IGP 76	38.82 (39.3)	23.02 (15.3)	72.92 (91.3)	31.5	0.40
GA 10	51.17 (60.7)	26.02 (19.5)	64.17 (81.0)	32.7	0.42
LSD (P=0.05)	3.79	1.78	1.73	5.21	-

Figures in parentheses are average per cent reduction and these values are transformed to $\sin^{-1} \sqrt{X}$.

Table 3. Seed yield (g m⁻²) of niger cultivars as influenced by *Cuscuta* infestation

Cultivars	Niger seed yield (g m ⁻²)					
	Late kharif 2002			October 2003		
	<i>Cuscuta</i> free	<i>Cuscuta</i> infested	Mean	<i>Cuscuta</i> free	<i>Cuscuta</i> infested	Mean
JNC 1	208	65	136	23	10	16
JNC 6	209	54	131	29	7	18
Ootacamund	140	46	93	29	12	21
IGP 76	172	21	97	20	5	13
GA 10	171	31	101	23	7	15
Mean	180	43		25	8	
LSD (P=0.05)						
<i>Cuscuta</i>		27			0.674	
Cultivars		30			1.066	
<i>Cuscuta</i> x Cultivars		NS			1.508	

NS—Not Significant.

RESULTS AND DISCUSSION

Effect of Densities of *Cuscuta* on Niger

Plant height of niger and percentage of niger plants infested with *Cuscuta* were reduced significantly in all the densities at 40, 60 and 80

days as compared to *Cuscuta*-free plots, however, the reduction at 0.25, 0.5 and 1.0 densities was less than at higher densities (Table 1). A single plant of *Cuscuta* in one m² caused 100% infestation at 80 days; however, increasing the area per unit *Cuscuta* plant, the infestation was less at higher densities. Niger population decreased with increasing densities of *Cuscuta*.

There was a decrease in niger seed yield from 52 to 99.2% at varying densities of *Cuscuta* (Table 1). The yield reduction was minimum in the lowest density of *Cuscuta* (0.25 m⁻²). The seed production capacity of *Cuscuta* was higher at lower densities (69.1 to 73.1 g m⁻²) than at higher density (32.4 g m⁻²). This may be due to availability of more food per unit plant that makes *Cuscuta* to grow and spread profusely and prolifically. In addition, seeds amounting 41,000 to 89,000 were added heavily to the soil seed bank with different densities indicating the severity of the problem for the subsequent crop.

Relative Tolerance of Niger Cultivars to *Cuscuta*

Reduction in niger plant height in *Cuscuta*-infested plots occurred immensely during the first 40 days, which was maximum in cv. GA 10 (60%), and minimum in cv. Ootacamund (26%). At 80 days, crop height was reduced to a considerable extent in all the cultivars and cv. JNC 6 and JNC 1 showed maximum reduction (28 and 27%). Per cent *Cuscuta* infestation at 75 days and *Cuscuta* seed yield at harvest were significantly higher in cv. JNC 1 (100% and 48.93 g m⁻²) and lowest in cv. Ootacamund (76% and 19.4 g m⁻²). This showed that the cultivars, JNC 1 and JNC 6 were more susceptible to *C. chinensis* (Table 2), while cv. Ootacamund showed some tolerance.

Reduction in crop seed yield was lower in cv. Ootacamund (Table 3), which showed comparatively higher degree of tolerance than other cultivars to *Cuscuta* infestation. Kumar and Kondap (1993) suggested in greengram and blackgram that the parasite growth was restricted to hardy stem of tolerant cultivars and early vigour eliminated the effect of parasite attack to some extent. The vigorous growth of cultivars, high pubescence of stems and hardness of stem resisted the entry of parasite haustoria into the cultivars.

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