Effect of Different Densities of *Cuscuta chinensis* on Lentil and Chickpea

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ABSTRACT

Increasing densities of *Cuscuta* significantly reduced the seed yields of lentil and chickpea. The losses in seed yield due to increasing densities of *Cuscuta* ranged from 20 to 95% in lentil and 28 to 100% in chickpea, indicating that at the same weed density, chickpea was more susceptible to this weed than lentil.

INTRODUCTION

Cuscuta (dodder) is an obligate stem parasite in the family Convolvulaceae. The plant comprises a twining stem and leaves, which are reduced to minute scales. The stem forms vascular connections with their host via a specialized organ called haustorium, which abstracts organic and inorganic solutes principally from the host phloem (Jeschke *et al.*, 1994). Chickpea (*Cicer arietinum* L.) and lentil (*Lens culinaris* Medic) are the important winter pulses grown in India for their economic importance and nutritive value besides maintaining soil fertility. In recent years, their cultivations were threatened by infestation of *Cuscuta chinensis* causing 87 and 85.7% reduction in the yield of lentil and chickpea, respectively (Moorthy *et al.*, 2003). Hence, the present investigation was conducted to find out the damage potential of *C. chinensis* at varying densities in lentil and chickpea.

MATERIALS AND METHODS

Field experiments were carried out at the National Research Centre for Weed Science, Jabalpur during winter seasons of 2002-03 and 2003-04. Treatments consisting of varying densities of *Cuscuta* (0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 in 2002-03 and 0.25, 0.5, 1, 2, 3, 4, 5, 6 and 7 *Cuscuta* plants m^{-2} in 2003-04) were replicated thrice in a randomized block design. The *Cuscuta* density of 0.25 and 0.50

m^{-2} was maintained by keeping 1 plant 4 m^{-2} and 2 m^{-2} areas, respectively. For the remaining densities, the plot size was 1 m x 1 m (1 m^2). Lentil (L-40-76) and chickpea (JG 16) were sown in rows 25 cm apart on November 10 during 2002 and November 16 during 2003 with a seed rate of 50 and 100 kg ha^{-1}, respectively. *Cuscuta* seeds after treatment with concentrated sulfuric acid for 30 min were broadcasted at the time of sowing of both the crops. *Cuscuta* densities as per the treatments and uniform plant population of crops were maintained at 20 days after sowing by removing the excess plants. All other weeds were removed as and when they appeared. The effect of *Cuscuta* density on per cent reduction in seed yields of lentil and chickpea was evaluated using simple empirical model. The pooled data of two years were fitted to a non-linear equation available in 'Microsoft Excel' statistical package using Polynomial 2nd order as follows :

$$Y = a + bx + cx^2$$

Where,

Y=per cent reduction in seed yield
a=estimate of Y in the absence of *Cuscuta*
b & c=estimates of the rate of reduction in
    Y as *Cuscuta* infestation increases
x=*Cuscuta* density

RESULTS AND DISCUSSION

There was a progressive decrease in yield of both the crops with increasing densities of *Cuscuta*

Table 1. Effect of densities of *Cuscuta* on its seed production and yield of lentil

Cuscuta density (No. m⁻²)	Seed yield (g m⁻²)				*Cuscuta* seed yield (g m⁻²)				Number of *Cuscuta* seeds m⁻² (estimated in '000)			
	Lentil		Chickpea		Lentil		Chickpea		Lentil		Chickpea	
	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04	2002-03	2003-04
0 (Control)	177	183	368	993	-	-	-	-	-	-	-	-
0.25	-	147	-	718	-	38	-	21	-	49	-	27
(1 plant 4 m⁻²)												
0.5	-	104	-	367	-	85	-	25	-	109	-	32
(1 plant 2 m⁻²)												
1	90	97	167	237	54	88	37	97	47	116	32	125
2	80	78	102	133	56	90	40	107	49	122	35	137
3	77	42	88	43	60	95	45	113	53	123	39	146
4	76	38	70	32	62	96	50	120	55	129	44	155
5	70	32	50	60	64	100	53	126	56	163	46	162
6	68	17	27	2	70	127	58	127	61	184	51	164
7	58	9	20	2	73	143	60	128	64	-	53	165
8	50	-	14	-	75	-	65	-	66	-	57	-
9	48	-	6	-	78	-	70	-	69	-	61	-
10	28	-	5	-	86	-	80	-	76	-	70	-
LSD (P=0.05)	24	19	23	95	9	29	23	28	-	-	-	-

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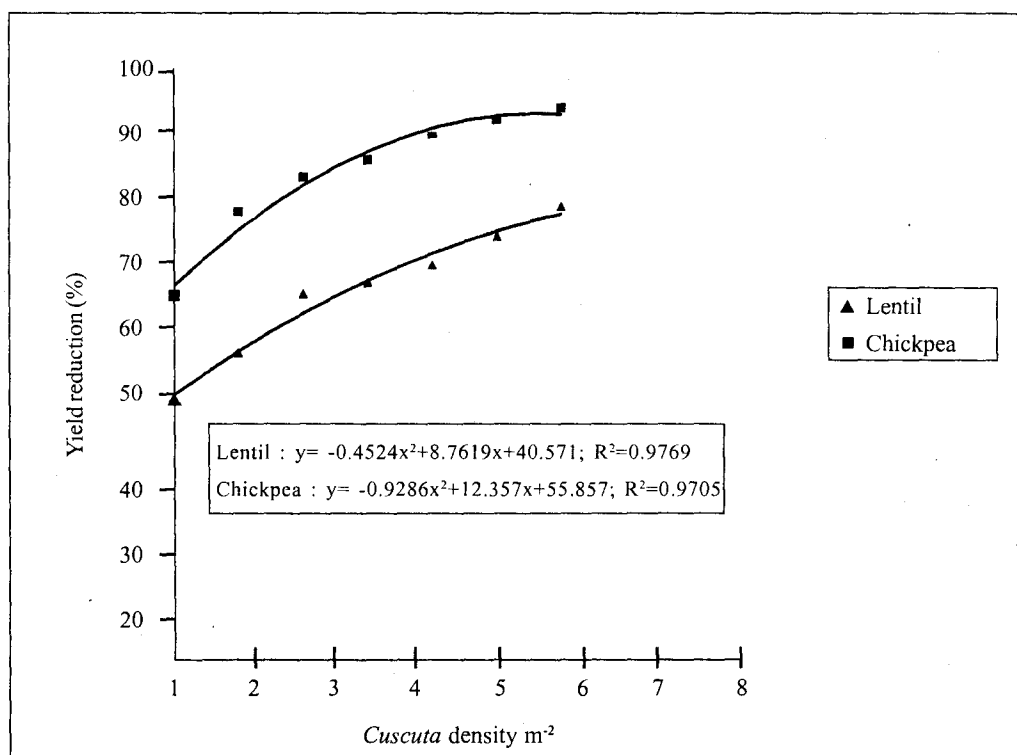
Fig. 1. Effect of *Cuscuta* densities on reduction in yield of lentil and chickpea.

The graph shows:

Lentil : $y = -0.4524x^2 + 8.7619x + 40.571$; $R^2 = 0.9769$

Chickpea : $y = -0.9286x^2 + 12.357x + 55.857$; $R^2 = 0.9705$

Y-axis: Yield reduction (%)
X-axis: *Cuscuta* density m^{-2}

as compared to *Cuscuta*-free conditions (Table 1). In 2002-03, the loss in yield due to *Cuscuta* density from 1 to 10 m^{-2} ranged from 49 to 84% in lentil and 55 to 99% in chickpea. The seed production capacity of *Cuscuta* under varying densities ranged from 54 to 86 g m^{-2} in lentil and 37 to 80 g m^{-2} in chickpea in 2002-03, which added 47,500 to 75,600 seeds m^{-2} in lentil and 32,200 to 70,200 number of *Cuscuta* seeds m^{-2} in chickpea to the soil seed bank. These results showed that the damage potential of even a single plant of *Cuscuta* was very high (49% in lentil and 55% in chickpea). During 2003-04, a single plant of *Cuscuta* 4 m^{-2} reduced the yield to 20% in lentil and 28% in chickpea. The per cent loss in chickpea was more as compared to lentil at lower densities (0.25 and 0.50 *Cuscuta* m^{-2}). The seed production capacity of *Cuscuta* at densities 0.25 and 0.50 m^{-2} was very less (38 and 85 g m^{-2} in

lentil and 20.8 and 25 g m^{-2} in chickpea) than at higher densities. Regression analysis conducted for yield loss indicated a non-linear yield response over the weed densities. The relationship fitted well with Polynomial 2nd order model. The regression lines indicated that at a given weed density, chickpea was more susceptible to *Cuscuta* than lentil (Fig. 1).

REFERENCES

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