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SOIL NITROGEN REQUIREMENT, SPACING, IRRIGATION AND WEED MANAGEMENT ON CHICKPEA (*Cicer arietinum* L.) PRODUCTIVITY ON REDDISH BROWN EARTH SOILS (RHODUSTALFS)

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INTRODUCTION

Chickpea is a popular food among Sri Lankan people consumed as boiled grain. However, it is not cultivated in Sri Lanka and the entire demand of chickpea is met through imports (Central Bank Report, 2006). Potential and prospects of chickpea cultivation in Sri Lanka was explained by Saxena *et al.* (1997). It was reported that being an important low input cash crop in the cropping systems of the semi arid tropics having adaptability to a wide range of environments, there is a high potential for introducing chickpea into farming systems in the Dry Zone of Sri Lanka under supplementary irrigation. Among the constraints for low productivity with chickpea, lack of improved crop management practices is the most prominent (Ramakrshna *et al.*, 2005). A comprehensive research review done by Saxena *et al.* (1997) reported that most of the research carried out with chickpea in Sri Lanka was related to varietal evaluation. Agronomic management aspects, except for optimum date for planting were not studied in detail.

Hence this study was undertaken to investigate the effect of spacing, nitrogen requirement, critical weed control stage and the irrigation interval on growth and yield of chickpea on Rhodustalfs soils.

MATERIALS AND METHODS

The research was carried out as three independent experiments from *yala* 2004 up to *maha* 2005/2006 seasons at Field Crops Research and Development Institute (FCRDI), Mahailluppallama in the low country dry zone of Sri Lanka on a Reddish Brown Earth soil (Rhodustalfs) (Panabokke, 1996). Chickpea Kabuli type variety ICCV-2 was used in all experiments. Triple superphosphate and muriate of potash were applied in the basal dressing at the rate of 140 and 100kg/ha respectively in all experiments. The management practices on plant density and nitrogen application for experiments 2 and 3 were based on the result obtained in experiment 1. Thus, 17.5kg/ha of nitrogen was applied at basal and 17.5kg/ha nitorgen was applied at flower initiation. Treatment structure for each experiment was as follows.

Experiment 1

The experiment was carried out in a split plot design with three replicates. Three N rates tested were 35, 70 and 105kg/ha as urea with 3 population densities (22, 33 and 44 plants/m^2) at the spacing of 30cm x 15cm, 30cm x 10cm and 45cm x 5cm respectively taking the nitrogen treatment as the main plot and plant density as the sub plot.

Treatment structure of experiment 1

1). Weedy up to 1st week; 2). Weedy up to 2nd week; 3). Weedy up to 3rd week; 4). Weedy up to 4th week; 5). Weedy up to 5th week; 6). Weedy up to 6th week; 7). Weedy up to 7th week; 8). Weeded control; 9). Unweeded control.

Experiment 2

The experiment was carried out in a Randomized Complete Block (RCB) design with three replicates. Two weeding schedules were executed as two independent trials. Seeds were row seeded at the spacing of 30cm x 10cm to have one plant per hill. Mammoty weeding was done weekly according to the weeding schedule.

Treatment structure of experiment 2

1). Weed free during 1st week only; 2). Weed free during 2st week only; 3). Weed free during 3rd week only; 4). Weed free during 4th week only; 5). Weed free during 5th week only; 6). Weed free during 6th week only; 7). Weed free during 7th week only; 8). Weeded control; 9). Unweeded control.

Experiment 3

Chickpea seeds were planted at 30cm x 10cm spacing. Treatments were arranged in a RCB design with three replicates. After planting all the plots were irrigated at the same time and thereafter eight different irrigation intervals were applied. From T1 to T4, there was only one irrigation schedule whereas from T5 to T8 there were two irrigation schedules executed before flowering and after flowering. Moisture contents at each irrigation were determined gravimetrically.

Treatment structure of experiment 3

T1-2 days interval; T2-4 days interval; T3-7 days interval; T4-12 days interval; T5-2 days interval before flowering and 4 days interval after flowering; T6-2 days interval before flowering and 7 days interval after flowering; T7-4 days interval before flowering and 7 days interval after flowering;T8-4 days interval before flowering and 12 days interval after flowering.

RESULTS AND DISCUSION

Experiment 1

The difference in number of pods per plant was significant only between 35 and 105kgN/ha. Number of pods per plant is low at 44 plants/m^2 where inter row spacing was 45cm but same in other density levels where inter row spacing was 30cm. Mohapatra *et al.* (1995) observed that wide row spacing (30cm) with 10 cm intra row spacing produced more branches and pods per plant but it had not increased the seed yield. No difference was observed in number of seeds/pod and 100 seed weight in every season. In seed yield, there was no difference among three nitrogen levels. Mohapatra *et al.* (1995) concluded that on a soil with poor available nitrogen, the crop responds up to 40kg N but there is only a 27% increase compared to 20kg N per ha. The results are in agreement with his findings, as Rhodustalfs soils are poor in nitrogen (Kalpage, 1974). However, application of nitrogen beyond 35kg/ha would not gain any economical yield increment on Rhodustalfs soils. With respect to plant density, 33 plants/m^2 gave a 20-25% yield increase compared to lowest plant density while 44 plants/m^2 gave 22-27% yield reduction.

Table 1. Effect of Nitrogen fertilization and spacing arrangement on yield and yield components of chickpea in *yala* 2004 and 2004/05 *maha* seasons.

	Pod number/ plant		*Seed number/pod*		*100 seed weight (g)*		*Seed yield (kg/ha)*	
	yala	*maha*	*yala*	*maha*	*yala*	*maha*	*yala*	*maha*
Nitrogen (kg/ha)								
35	15	11	1.02	1.03	17.22	17.88	627	729
70	17	13	1.02	1.03	18.44	18.11	778	804
105	18	15	1.03	1.06	18.77	18.77	993	731
LSD	2.9	3.0	NS	NS	NS	NS	399	182
Spacing								
30cm x 15cm	18	16	1.02	1.04	17.91	18.58	913	700
30cm x 10cm	17	16	1.00	1.04	17.75	18.33	1144	842
45cm x 5cm	14	12	1.04	1.03	17.75	18.16	707	509
LSD	1.1	2.1	NS	NS	NS	NS	96	44
CV%	8.2	10.0	7.5	12.0	9.4	13.5	8.7	7.0

Experiment 2

Results showed a significant yield reduction after the second week. Hence, weeding should be started at 14DAP. This clearly indicated that the critical period of weeds for chickpea commenced at 2 weeks after planting and threshold competitive duration went up to seven weeks after planting (Fig. 1).

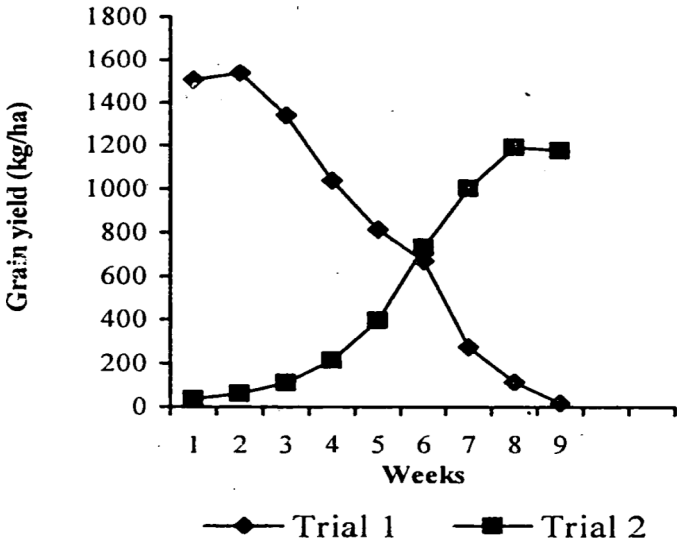

Figure 1. Yield response of chickpea under different weed infestation situations.

Experiment 3

During the cropping period, total rainfall was 43.2mm and number of rainy days was ten. Results showed that seven day irrigation interval gave the highest chickpea yield (Table 3) and soil moisture content at irrigation was 6%. When 12 days irrigation was maintained (T4), the soil moisture level at irrigation was 2% and it has increased up to 16% when a 2 days interval was maintained (T1). Four days irrigation interval gave the second highest seed yield where soil moisture content at irrigation was 9 %. Irrigation at four days before flowering and 12days after flowering treatment gave the lowest seed yield indicating after flowering irrigation was important for seed setting. Therefore, RBE soils need more irrigation as their water holding capacity is low (Panabokke, 1996).

Table 3. Dry seed yield of chickpea at different irrigation intervals and the moisture level at each irrigation.

Irrigation interval	*Dry seed yield (kg/ha)*	*Moisture level at irrigation (%)*	
		First schedule	*Second schedule*
T1	591	16	-
T2	889	9	-
T3	1024	6	-
T4	515	2	-
T5	622	20	7
T6	744	18	3
T7	713	8	3
T8	313	8	2
LSD	345	-	-
CV%	29	-	-

CONCLUSIONS

To obtain optimum chickpea yield, the most suitable plant density is 33 plants/m^2 (30cm x 10cm), and nitrogen application of 35kg/ha. Irrigation interval should be 7 days and weed control measures adopted during 2-7 weeks periods.

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