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Competition Between *Celosia argentea* L. And Sorghum With Reference To Weed Positions

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Competition between *Celosia argentea* and *Sorghum bicolor* (syn. *S. vulgare*) was studied by keeping the crop-weed density at 16:8, 16:16 and 16:32 with the weed position in within and in between the crop rows. The weeds showed very high competitive ability with the crop plants under both the weed positions but more competitive in the within position. The depressive effects by the weed plants on the crop plants was increased with increase in the weed density. Biomass, yield and minerals were low in the crop due to the weed competition.

The importance of position of weed plants in crop-weed competition is known (Bleasdale,1959). The weed - *Celosia argentea* Linn. infests the crop fields during monsoon at Rajkot. Further, the competitive ability of this weed with maize and wheat (Pandya & Baghela, 1973) and its allelopathic potentials have been studied (Pandya1975,1977; Pandya & Pota 1978).

MATERIALS & METHODS A total of 35 plots of m sq each were prepared by making 2 kg of farm manure per plot. In the plots, the weed plants were raised from seeds collected from sorghum fields. The crop plants were raised from the caryopses of *Sorghum bicolor* (L.) Moench (syn.*s. vulgare* Pers.), hybrid S.H.1, the variety commonly cultivated in Rajkot area. Both the weed and crop were sown. Within sowing treatment,4 rows, 20 cm apart from each other were maintained and for the in between sowing treatment, 7 rows, 10 cm apart from each other for alternate sowing of the crop and the weed in rows were made. The crop and weed density per m sq for both treatments was maintained as follows: 16:0,16:8,16:16 and 16:32.

The crop-weed plots were irrigated periodically, considering the local rainfall data. Thinning and weeding were done periodically to maintain the plots at the desired crop-weed density.

The biomass of both crop and weed plants was measured at interval of 20 d after their sowing. Shoot height, root length and number of leaves were recorded. The biomass was separated into above and below ground and dried in an oven at 80°c till constant weight. From the mature sorghum crop plants caryopses were separated and dried at room temperature.

Soil samples were collected up to a depth of 20 cm at the time of observation. The soils were dried at room temperature and passed through 1 mm sieve before drying in an oven at 105°c until constant weight. The oven dried plant biomass was ground to powder. The powdered biomass and soils were analysed for calcium, sodium, and potassium in a flame photometer (De 1962), organic carbon and total nitrogen (Pandeya *et al.* 1968, Jackson 1962). Soil pH was measured in single electrode pH meter and soil moisture was estimated by oven dry method (Pandeya *et al.* 1968).

RESULTS (1) **Effect on root, shoot and leaves** - Root length and shoot height of *S.bicolor* decreased with increase in weed density, however, the decrease was slightly more in

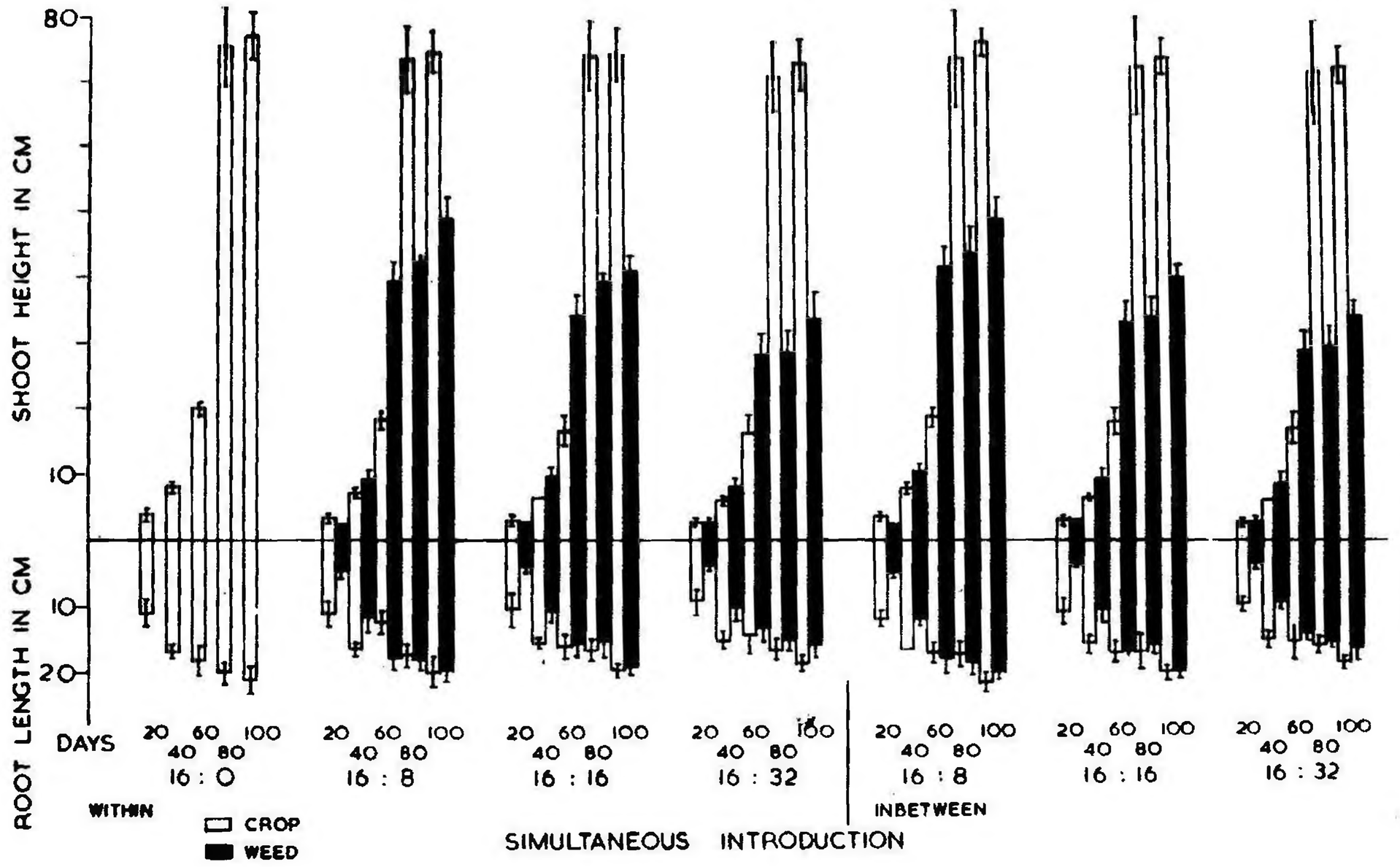

Fig. 1. Effect of the competition on shoot height and root length of the crop and the weed plants

the within position than that in the in between position (Fig.1.). The shoot height of the weed plants was more under the in between position and it decreased with increase in density.

The number of leaves of crop plants was less under all crop- weed ratios in either position compared with the control and it was comparatively low under the within position than the in between position (Fig.2). The number of weed leaves decreased with increase in weed density and were comparatively more in the in between position than the within position.

(2) **Effect on biomass and yield** - The crop biomass was low under all the crop-weed ratios compared with the control (Fig.3). Above ground biomass of *Sorghum* was more under the in between position than the within position. Similar results were obtained for the belowground biomass of crop plants except in 100 d of growth, where it was more in the within position. In the weed plants both the above and below-ground biomass was more under the in between position. The total biomass increased with increase in the number of plants per m sq.

The total number of caryopses and its weight per plant and per m sq were less than the control plants. However, the yield was comparatively more under the in between position than the within position (Table 1).

(3) **Plant mineral contents** - The crop plants grown with the weed under both the positions showed reduced mineral content compared with control plants (Fig. 4). However, the mineral contents were more in the crop plants of the in between position than the within position. The mineral content also decreased in the crop plants with increase in weed density.

Mineral contents were more in weeds than in the associated crop plants under both the positions and increased in the former with increase in their density. Comparatively, mineral contents were more in the weed plants of the in between position than the within position.

(4) **Soil under the influence of the crop-**

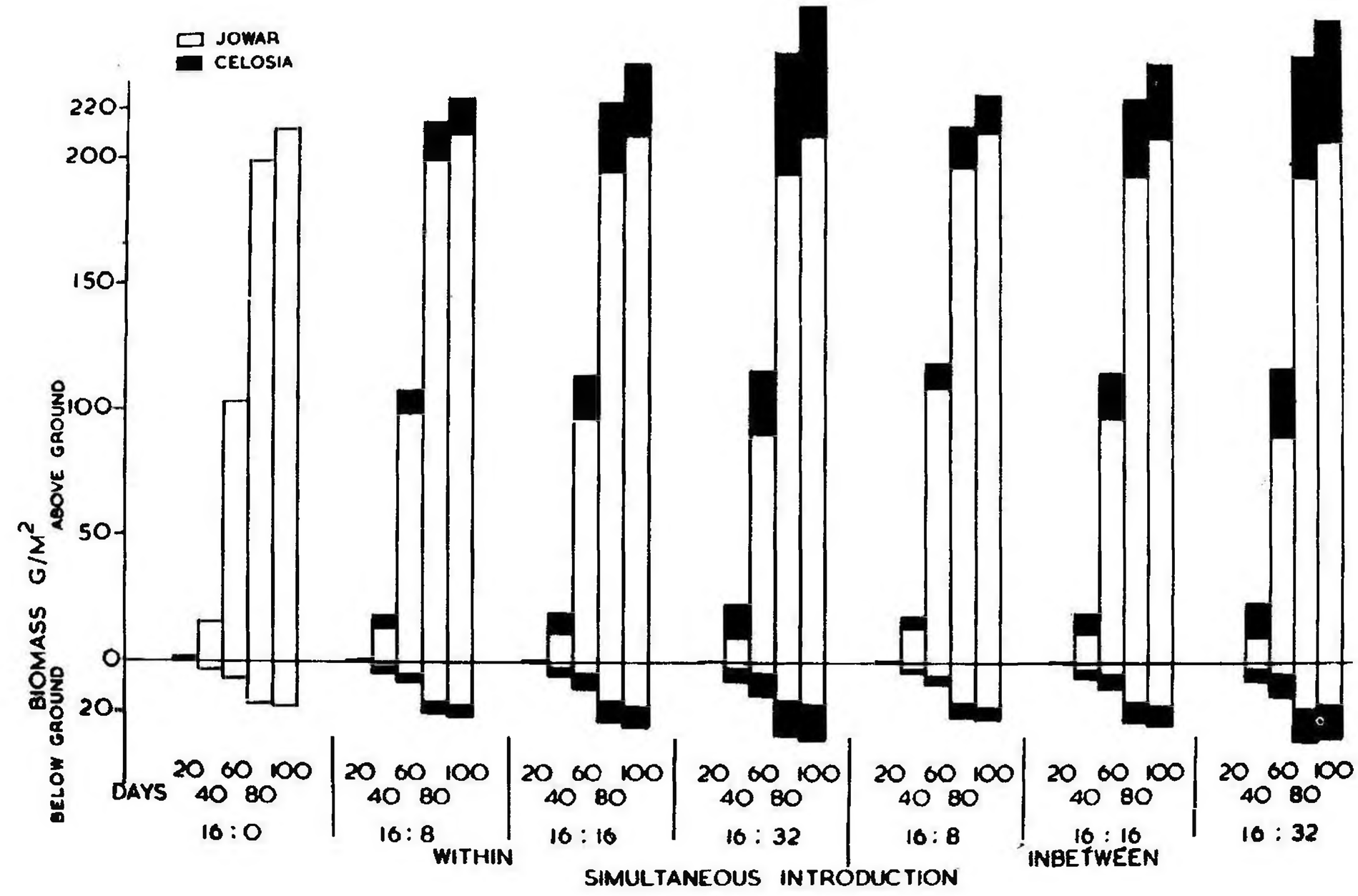

Fig. 2. Effect of the competition on number of leaves of the crop and the weed plants.

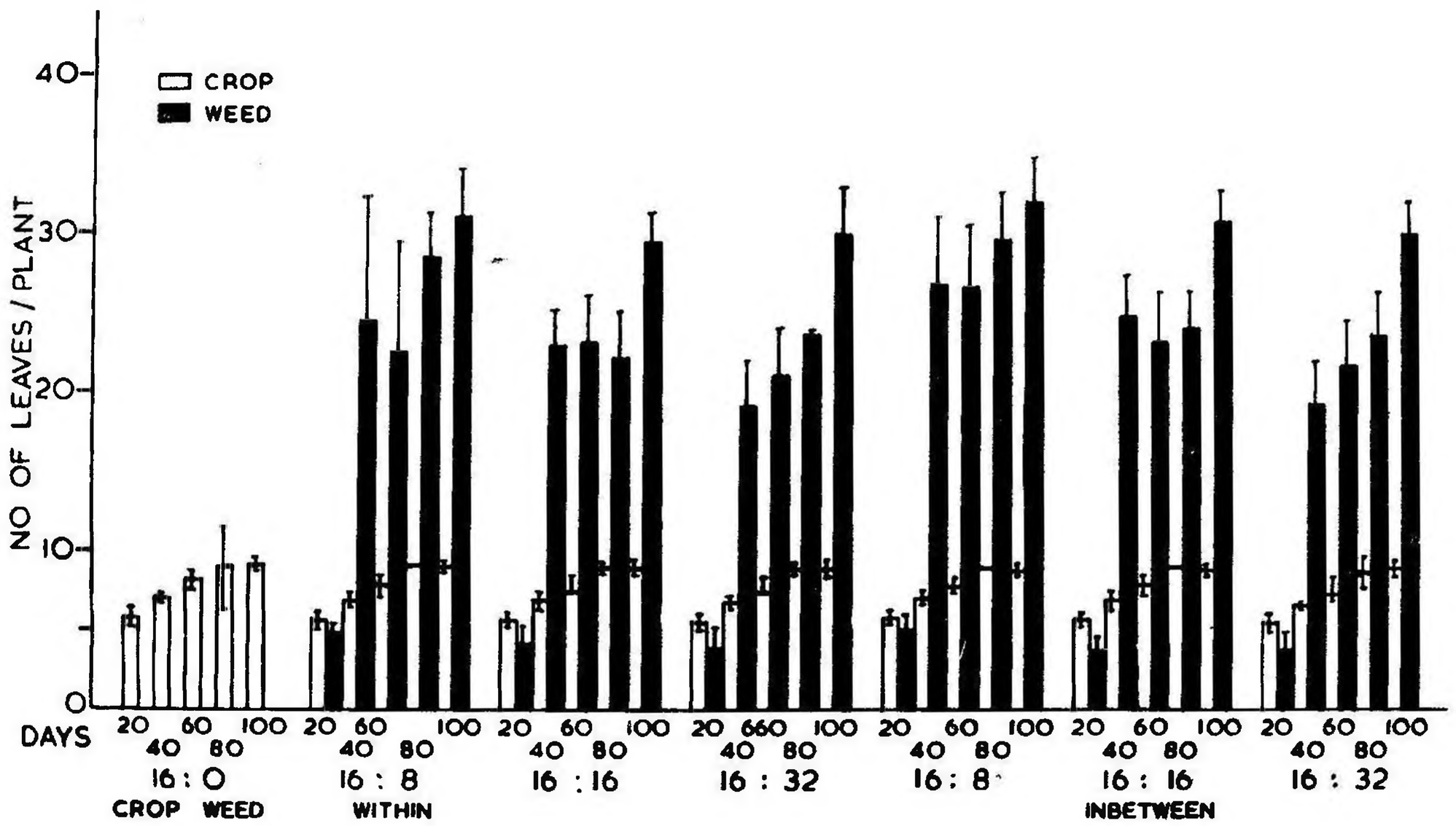

Fig. 3. Biomass production of the crop and the weed plants under the competition.

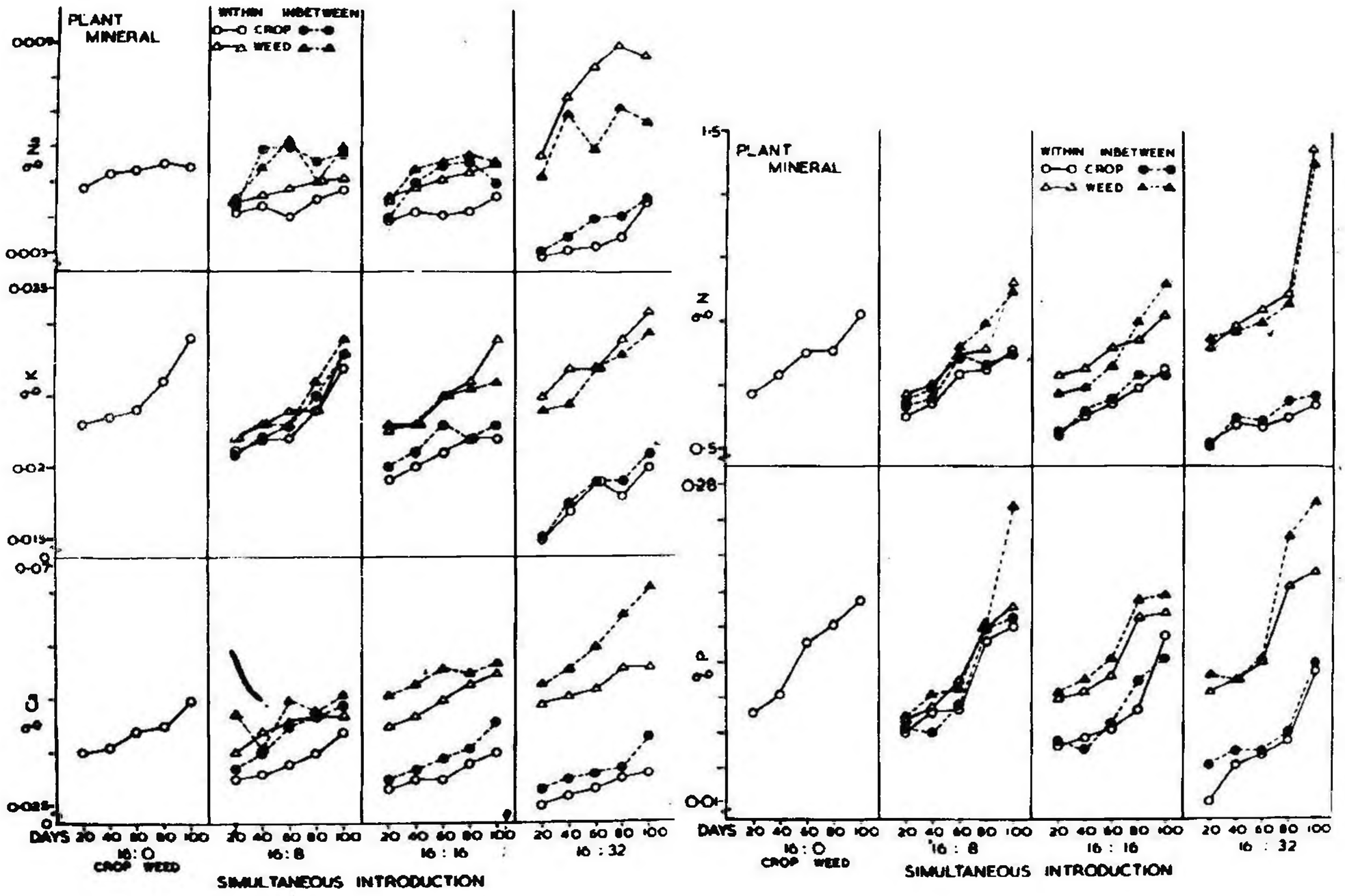

Fig. 4. Mineral content of the crop and the weed plants under the competition.

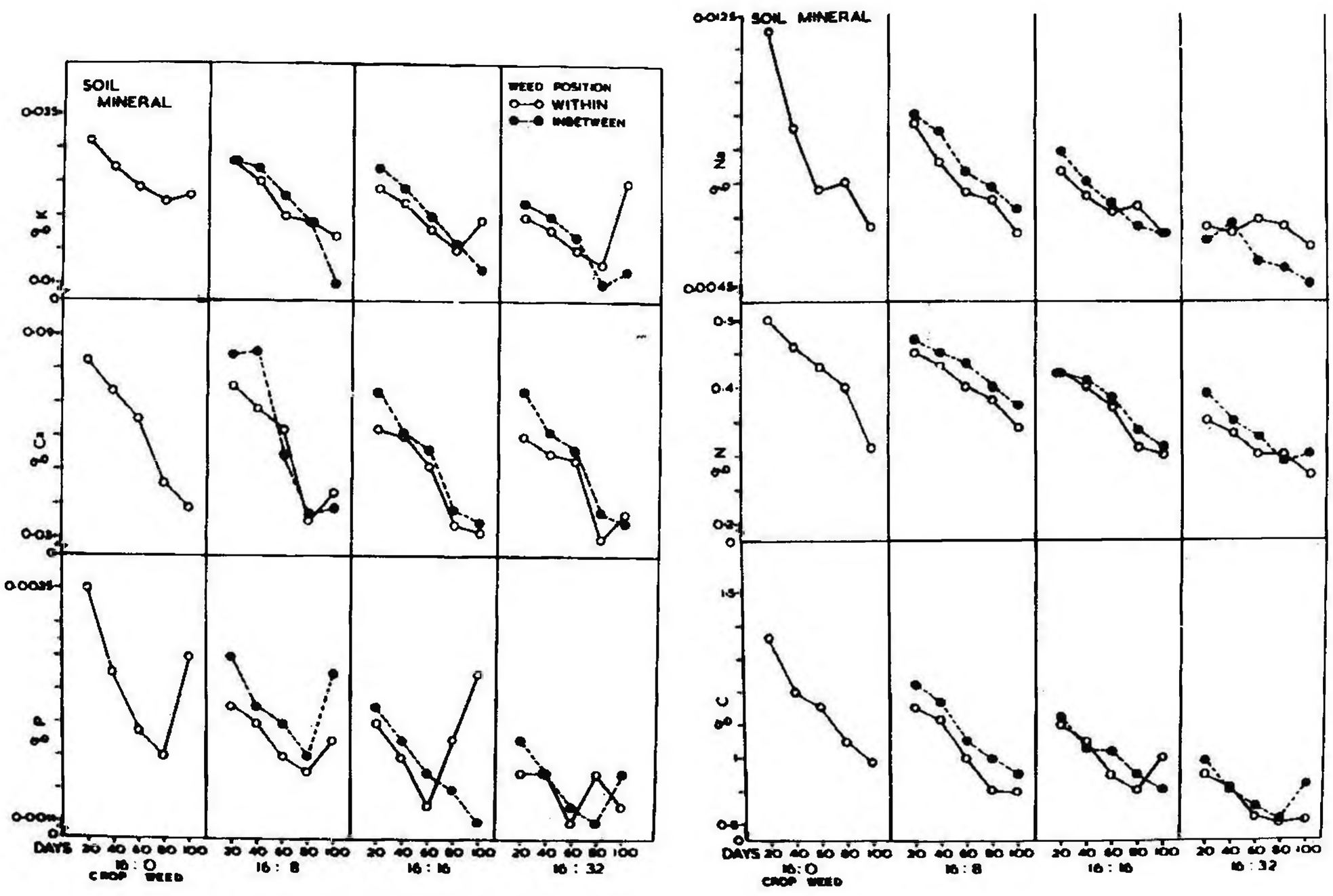

Fig. 5. Soil mineral status under the crop-weed competition.

Table 1 Yield of sorghum under competition with *Celosia argentea* L.

Weed Position	Crop: Weed density per m^2	Number of Caryopses		Weight of Caryopses in g		Weight of 100 caryopses in g
		Per Plant	Per M^2	Per Plant	Per M^2	
	16:0 Control	391 ± 175	6,250	8.5 ± 3	136	1.25
Within	16:8	387 ± 123	6,197	8.0 ± 4	128	1.03
	16:16	388 ± 204	6,162	8.3 ± 3	132	0.95
	16:32	361 ± 220	5,769	7.5 ± 2	120	0.87
In between	16:8	388 ± 152	6,210	8.0 ± 5	128	1.0
	16:16	390 ± 120	6,242	7.9 ± 3	127	0.97
	16:32	365 ± 249	5,843	7.7 ± 3	123	0.90

± Standard deviation

weed competition - The plots showed soil moisture of 10.5 ± 1.4% up to 80 d, but decreased to 5.4 ± 1.4% at 100 d. The soil pH ranged from 7.2 to 7.6.

All the soil minerals decreased from sowing to harvest time. The decrease was more with increase in weed density under both the positions, however, it was more in the within position than in the in between position (Fig.5).

DISCUSSION Root and shoot length, number of leaves, biomass and plant mineral contents were less in both the competing plant species under the within position than those in the in between position. In the within position, both the crop and the weed plants were in close association compared with the in between position. Therefore, competition for mineral absorption is likely to be more in the within position, which ultimately affected biomass production and yield. The effect was less in the in between position because both the species were grown in separate rows and not in very close contact. Further the crop plants may shade on the weed plants which would be more under the within position than that in the in between. Therefore, the weed plants under the within position contained reduced biomass and leaves than that under the in between position.

Irrespective of the position, the weed showed very high competitive ability with *Sorghum* plants. Biomass of the crop plants was more than the weed plants due to smaller size of the weed plants. We have already reported reduced biomass of weeds compared with *Sorghum* plants (Pandya & Purohit 1976).

Total plant biomass (crop + weed) increased with increase in the total plant density per m sq. This indicated capacity of the soil to bear more plants per unit area. However, the reduction in biomass of crop plants which were grown with the weed indicated depressive effect of weed plants on crop growth. The crop is a biased dominant species because of selection but the weed species is unwanted but grow its own with crop, became dominant by virtue of increased density. It is likely that under the artificial crop land ecosystem, diversity of species (here crop and weed) increases productivity, but the dominant crop species showed lesser production in association with the weed is due to the competition of weed plants.

Weaver & Clements (1938) stated that the competition is closer between similar forms than the dissimilar forms. Here both the species are dissimilar, however, the weed depressed the crop growth and thus showed very high competitive ability with the crop. The weed is reported to possess allelopathic potential via secretion of some toxic substances into the rhizosphere (Pandya 1975, 1977; Pandya & Pota 1978) which may be responsible for the depressive effect on the crop plants.

Reduction in the yield of crop plant due to the weed has been well documented (Crafts, 1975, Alkamper,1972). *C. argentea* decreased the biomass production of sorghum (Desai 1975), bajra (Pandya 1976), maize (Pandya & Das 1982) and wheat (Pandya & Baghela 1973) and both biomass and yield in pearl millet (Pandya & Vyas 1982). The decrease in sorghum crop yield ranged from 2.8 to 11.5 per cent. According to Cramer (1967) loss in maize yield due to weed competition in Asia is about 15 per cent.

Higher mineral contents by weed plants than crop plants have been reported for sorghum crop field(Pandya & Purohit 1976), and also in the weed in competition with pearl millet (Pandya & Vyas, 1982). Long (1974) also showed that *Echinochloa colonum* had high nutrient levels compared with the competing rice plants. Indeed weeds are richer in nutrients than the cultivated plants (Alkamper *et al.* 1975). Further, Alkamper (1977) stated that with increase in weed infestation, the loss of nutrient can be very great due to more uptake of the nutrient by weeds.

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