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Effect of sowing date on performance of castor (*Ricinus communis*) cultivars during summer in rice (*Oryza sativa*) fallows

P. SESHA SAILA SREE[1] AND B. BHASKAR REDDY[2]

Department of Agronomy, College of Agriculture, Acharya N.G. Ranga Agricultural University, Hyderabad, Andhra Pradesh 500 030

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ABSTRACT

An experiment with 3 dates of sowing and 4 castor (*Ricinus communis* L.) cultivars was conducted at Agricultural College Farm, Rajendranagar, Hyderabad, during summer seasons of 1995–96 and 1996–97 after the rainy-season rice (*Oryza sativa* L.). Growth parameters, yield attributes, seed and oil yields and harvest index of castor were higher when the crop was sown on 5 January followed by 20 December. Delayed sowing of castor on 20 January reduced the seed yield by 14 and 11%, respectively, compared to 5 January and 20 December sown crop. Among cultivars tested, hybrids recorded significantly higher growth, yield components, seed and oil yields than the varieties. The interaction between dates of sowing and cultivars was non-significant.

Key words: Castor, Dates of sowing, cultivars

In some ayacut areas of southern Telanagana Zone of Andhra Pradesh, instead of keeping the land fallow under situations of limited water availability for cultivation of second rice crop, low water-requirement crops like castor could be grown successfully with limited available water. The crop also vacates the field for succeeding rainy season in time (Ganga Saran and Gajendra Giri, 1987). The first and foremost aspect among all the agronomic practices is sowing of castor after rainy-season rice at an appropriate time with suitable cultivar that fits well in a given agro-climatic condition and these aspects of crop production have not been studied so far in rice fallows of Southern Telangana Zone of Andhra Pradesh. Hence this investigation was conducted for 2 successive summer seasons to identity optimum sowing time for different cultivars of castor after rainy-season rice.

MATERIALS AND METHODS

The field experiment was conducted during the summer seasons of 1995–96 and 1996–97 at the Agricultural College Farm, College of Agriculture, Rajendranagar, Hyderabad, Andhra Pradesh, on sandy clay loam soil having pH 8.0, available N 150.1 kg/ha, available P_2O_5 22.8 kg/ha and available K_2O 200 kg/ha. Three dates of sowing 20 December, 5 January and 20 January and 4 cultivars of castor ('DCS 9', 'Aruna', 'GCH 4' and 'DCH 30') were tested in split-plot design with dates of sowing in main plots and cultivars in sub-plots, The treatments were replicated 3 times. A fertilizer dose of 80 kg N, 60 kg P_2O_5 and 30 kg K_2O/ha was given under all the treatments uniformly. The crop was sown at a spacing of 60 cm × 45 cm. Entire level of P_2O_5 and K_2O was applied at the time of sowing. Nitrogen was applied in 3 splits – half as basal, one-fourth at 30–35 days after sowing and the remaining one-fourth at 70–75 days. Light irrigation was given based on evaporative demand. An application of Pendimethalin @ 1.2 kg a.i./ha was done at pre-emergence and hand-weeding was done at 30 days in each date of sowing. The crop was handpicked thrice and at maturity the crop was harvested

The maximum temperatures at sowing was 25.1°C, 27.7°C and 29.2°C and minimum temperature 12.5°C, 13.3°C and 15.7°C, respectively, in 20 December, 5 January and 20 January date of sowing. During crop-growth period the maximum temperature ranged between 24.1°C and 41.2°C, 28.5°C and 41.3°C, and 29.2°C and 41.8°C in 20 December, 5 January and 20 January dates of sowing respectively.

RESULTS AND DISCUSSION

Effect of sowing date

Period of emergence, 50% primary spike formation and maturity: Days taken for emergence, 50% primary spike formation and maturity was significantly earliest

Present address: [1]Regional Agricultural Research Station, Nandyal, Andhra Pradesh 518 503; [2] Regional Agricultural Research Station, Jagtial, Andhra Pradesh 505 327

when the crop was sown on 20 January (Table 1). The crop sown early flowered late due to prolonged vegetative period as a result of low temperatures (Leong and Ong, 1983) compared to late sowings in January (Table 1).

Growth parameters: Significantly higher plant height and dry-matter production in harvest were recorded in 5 January sown crop compared to all other sowing dates. On the other hand, leaf-area index at harvest was not significantly influenced by dates of sowing (Table 1).

Yield attributes: The number of effective spikes/plant was not significantly influenced by dates of sowing, while sowing of castor on 5 January resulted in significantly more number of capsule/plant, longer primary spikes and 100-seed weight over that of 20 January sown crop of castor (Table 1).

Seed yield, oil content and oil yield: Sowing on 5 January resulted in significantly higher seed and oil yields over that of 20 December and 20 January sowing (Table 1). Oil content was not influenced significantly by sowing dates. Further, the harvest index of castor both in 20 December and 5 January sown crop was at par with each other and significantly superior to that of 20 January sown crop (Table 1).

The temperature experienced by 5 January sown crop at various phonological stages was favourable and resulted in significant increment in growth parameters, yield attributes and thereby seed yield. Shorter days and lower temperature at the critical stages of crop growth in early-sown crop (20 December) reduce photosynthesis and other physiological activities of the plant (Babu, 1985), which was probably the reason for reduction in growth and yield in 20 December sown crop compared to 5 January sown crop. Reduction in yield attributes and yield of castor with 20 January sown crop was due to decreased photosynthetic accumulation in plants due to decreased growth period of crop (Jai Kumar, 1993) and also due to blasting of flowers as a result of high temperature (40°C and above) at flowering (Weiss, 1971).

Performance of cultivars

Period of emergence, 50% primary spike formation and maturity: The variety 'Aruna' was significantly earlier for these parameters compared to all other cultivars. Emergence period of the variety 'DCS 9' was significantly more than the hybrids, 'GCH 4' and 'DCH 30' which were comparable. This was due to varietal differences in susceptibility to low seed-bed temperatures on subsequent emergence. Further, the days required for primary spike formation and maturity in variety 'DCS 9' and the hybrids, 'GCH 4' and 'DCH 30' were at par with each other (Table 1).

Growth parameters: Plant height, dry-matter production and leaf-area index at harvest were significantly higher with the hybrids than with the varieties (Table 1). Superior performance of hybrids to varieties in growth could be owing to deep root-system and regeneration capacity of the shoot, which enabled the hybrids to extend its growth period. The root system in the hybrid was not affected by the compactness of the soil profile in the rice-based system, while that of variety was constrained (Rao *et al.*, 1986). Further, the superiority of castor hybrids might be due to higher leaf reflectance and transmission properties leading to quick response of stomata as reported by Rao *et al.* (1998).

Yield attributes: The cultivar 'Aruna' in spite of having more number of effective spikes/plant, recorded significantly lower number of capsules/plant, length of primary spikes/plant and 100-seed weight than all other cultivars.

Table 1. Effect of date of sowing on growth, yield attributes, yield and harvest index of castor cultivars during summer after rainy season (mean data of 1995–96 and 1996–97)

Treatment	Emergence period (days)	50% primary spike formation (days)	Maturity period (days)	Plant height at harvest (cm)	Dry matter at harvest (g/m^2)	Leaf-area index at harvest	Effective spikes/ plant	Cap-sules/ plant	Length of primary spike (cm)	100-seed weight (g)	Seed yield (kg/ha)	Oil content (%)	Oil yield (kg/ha)	Harvest index (%)
Date of sowing														
20 Dec	13.3	47.6	143	71.7	485	0.69	3.5	86.3	34.2	28.5	1,753	43.3	773	38.5
5 Jan	11.8	45.8	140	76.3	518	0.71	3.7	9.5	33.1	29.3	1,822	44.5	817	38.4
20 Jan	10.6	43.4	135	68.1	457	0.67	3.0	81.6	26.8	26.9	1,564	44.0	695	36.7
CD (P=0.05)	0.6	0.7	06	4.2	30.0	NS	NS	4.9	2.3	0.9	38	NS	39	0.9
Cultivar														
'DCS 9'	14.2	47.5	142	72.4	467	0.68	2.6	73.1	28.9	29.8	1,613	44.6	719	37.1
'Aruna'	9.0	42.2	133	65.2	377	0.5	4.6	75.5	21.4	19.7	1,172	39.8	472	33.9
'GCH 4'	11.9	46.6	140	74.7	548	0.77	3.0	100.6	37.4	31.3	2,000	45.5	910	40.0
'DCH 30'	12.4	46.1	141	75.9	555	0.78	3.4	103.3	37.7	32.0	2,069	45.7	946	40.5
CD (P=0.05)	0.6	1.3	2.3	2.0	38.0	0.05	0.3	6.3	3.0	1.5	97	1.3	52	0.9

Both the hybrids, 'GCH 4' and DCH 30' were at par and significantly superior to those of the varieties (Table 1).

Seed yield, oil content and oil yield: The hybrids ('GCH 4' and DCH 30') recorded significantly higher seed yield and harvest index over varieties ('DCS 9' and 'Aruna') and both the hybrids were at par with each other (Table 1). Oil content in seed in both the hybrids and variety 'DCS 9' were comparable and significantly superior to 'Aruna'. However, oil yield was significantly higher with 'DCH 30' compared to 'GCH 4' which in turn was significantly superior to varieties (Table 1). The interaction between dates of sowing and cultivars was found nonsignificant.

Thus, higher seed yields of summer castor after the rainy-season rice could be realized by sowing hybrids, either 'DCH 30' or 'GCH 4' during the first week of January (5 January).

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