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Effect of Sowing Date on the Performance of Two Sesame (*Sesamum indicum* L.) Cultivars under Irrigation at Kennana, Sudan

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Abstract: The effect of five sowing dates (15/6, 1/7, 15/7, 1/8 and 15/8) on phonology and yield of two sesame cultivars grown under irrigation was studied at Kennana Sugarcane Research Farm during 2001and 2002 seasons. The results showed that plants sown earlier (June sowing) significantly took more days to 50% flowering and physiological maturity than the late-sown plants (August sowing) in both seasons. In contrast, no significant difference between the cultivars was recorded in number of days to 50% flowering. Seed yield and yield components were significantly affected by sowing date. Early-sown plants (mid June) gave 100% and 75% higher seed yield than the late-sown plants (mid August) in the first and the second season, respectively. The higher seed yield of the early-sown plants was associated with high number of capsules, number of seeds per capsule and seed weight. The cultivar Promo significantly exceeded Khidir in seed yield, capsule setting and in number of seeds per capsule particularly in the first season. It can be concluded that the optimum sowing date for sesame under irrigation at Kennana is mid June, and that the cultivar Promo is more promising than the cultivar Khidir.

Key words: Sesame; sowing date; irrigation

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INTRODUCTION

Sesame (*Sesamum indicum* L.*)* is probably one of the two most ancient oil crop known and used by man. It is basically a short day plant, but some cultivars have become adapted to various light periods. Variations in rainfall and temperature patterns have great influence on growth and yield of the crop (Weiss 1971; Nath *et al*. 2001)). In Sudan, sesame is grown mainly under rainfed conditions in the mechanized and traditional farming systems where the total area and production fluctuated from year to year and from one location to another (Abdalla and Abdel Nour 2001; Khidir 2007).

Early research findings in Sudan and elsewhere showed that sesame cultivars are variable in their response to date of sowing, and more than 80% reduction in seed yield was obtained when sowing was delayed (Khidir 1981; Osman 1985; Aslam *et al*. 1989; Ahmed 1998; El Mahdi *et al*. 2007). Introduction of sesame in irrigated schemes is becoming a necessity, bearing in mind the release of new cultivars with high yield potentials. Therefore, research on cultural practices of the crop under irrigation is gaining importance and is greatly needed. Hence, the objectives of this study were to clarify the influence of sowing date on some phonological characters, yield and yield components of two sesame cultivars grown under irrigation.

MATERIALS AND METHODS

An experiment was conducted at Kennana Sugarcane Research Farm (13° 10′N, 32°40′E and 410 m *asl*) during the summers of 2001/02 and 2002/03 seasons. Table 1, gives the average temperature, relative humidity, hours of sunshine and rainfall during the experimental period. The climate of the locality is hot, semi-arid with rainy summer and cool dry winter. The rainy season extends from June to October, with maximum in August. The soil of the site is Vertisol (typic chromustert, very fine smectitic, isohyper thermic). The experimental area was preirrigated, disc ploughed, harrowed and leveled. Ridges were made 80 cm apart. The preceding crop was sugarcane (4^{th} ratoon).

Table 1. Temperature, relative humidity, hours of sunshine and rainfall at Kennana area during 2001 and 2002 seasons

	2001						2002					
	June	July	Aug.	Sept.	Oct.	Nov.	June	July	Aug.	Sept.	Oct.	Nov.
Temp. max ^{o}C	38.5	34.6	30.2	32.9	35.6	36.6	35.4	34.0	30.9	33.8	37.6	35.8
Temp. min ^{o}C	24.4	22.4	21.8	22.1	21.3	19.0	24.0	22.7	22.2	22.0	21.9	19.6
RH (%)	61.0	76.0	84.0	79.0	65.0	42.0	62.0	77.0	84.0	76.0	59.0	38.0
Hrs of sunshine	9.2	6.1	6.2	7.9	8.7	10.3	8.0	6.0	5.9	8.1	9.4	10.5
Rainfall (mm)	23.0	119	75	102	46	-	45	163	106	41	8.0	-

The experimental plot was 10.0x5.6 m, and the intra-row spacing was 25 cm. Sowing was done manually on the top of the ridges, and the plants were thinned four weeks after sowing to achieve a plant population of approximately $1.5x10^5$ plants ha^{-1} (i.e., 3 plants $hole^{-1}$). Nitrogen (urea) was applied at a rate of 80 kg N ha^{-1} immediately after thinning. The plots were hand weeded to ensure weed-free conditions and irrigation water was applied when necessary (four times in both seasons).

Five sowing dates (15/6, 1/7, 15/7, 1/8 and 15/8) and two sesame cultivars (Khidir and Promo) were arranged in 5x2 factorial experiment in a randomized complete block design with three replications. The studied characters were days to 50% flowering, days to physiological maturity, number of capsules $plant^{-1}$, number of seeds $capsule^{-1}$, 1000-seed weight, and seed yield per hectare. The collected data were statistically analyzed using MSTAT-C computer programme and the means were compared using the least significant difference.

RESULTS AND DISCUSSION

Only the main effect of the treatments is presented, because no significant interactions between sowing dates and cultivars were found in the measured parameters. The number of days to 50% flowering was greatly affected by sowing date in both seasons (Table 2). This may be due to the greater fluctuation in temperatures and hours of sunshine during the ontogeny of the plant (Table 1). In this respect, plants of the earliest sowing (15/6) took more days to flowering compared to the late-sown plants (15/8), and there was no significant difference between the two cultivars in number of days to flowering in both seasons. These results are in accord with the previous findings reported by Lee and Choi (1985) and Lee *et al.* (1988) who indicated that temperature and photoperiod played a major role in sesame flower-induction.

Table 2. Effect of sowing date and cultivars on phonological characters of sesame grown under irrigation

	Days to 50% flowering			Days to physio. maturity		
	01/02	02/03	Avg	01/02	02/03	Avg
Sowing date						
Mid June	49a	56a	52.5	106a	107b	106.5
Early July	47b	50b	48.5	105a	110a	107.5
Mid July	44c	49b	46.5	96b	110a	103.0
Early Aug.	41d	44c	42.5	90c	96c	93.0
Mid Aug.	38e	37d	37.5	88c	85d	86.5
LSD (5%)	0.7*	2.0*		2.0*	2.2*	
Cultivar						
Khidir	44a	47a	45.5	98a	104a	101
Promo	44a	48a	46.0	95b	99b	97
LSD (5%)	0.7	2.0		1.2*	1.4*	

Means followed by similar letters in each column are not significantly different (P≥0.05), according to the least significant difference (LSD).

Days to physiological maturity were significantly affected by sowing date and cultivars (Table 2). In this regard, maturity was accelerated as sowing was delayed, and the differences between sowing on 15/6 and 15/8 were 18 and 22 days in the first and the second season, respectively. Langham (1985) indicated that days to maturity depend on date of sowing and the prevailing temperature, while Mulkey *et al.* (1987) reported that late sowing and high temperature accelerated maturity in sesame. These findings are in agreement with the current results, where the late-sown plants encountered relatively higher temperature during their development (Table 1). The cultivar Promo was earlier in maturity than Khidir in both seasons, although as previously stated the two cultivars flowered at almost the same time. Similar results were reported by Ahmed (1998) working with the same cultivars.

The number of capsules plant^{-1} was greatly influenced by the sowing date ($P \leq 0.01$). Mid June sowing gave significantly higher number of capsules per plant than the other four sowing dates which were not significantly different in the second season (Table 3). Generally, the trend was a reduction in the number of capsules per plant as sowing was delayed. Promo plants produced significantly ($P \leq 0.05$) more capsules than those of Khidir in both seasons. Weiss (1971) reported that in sesame the number of capsules plant^{-1} is greatly affected by the temperature regime during fertilization, and that low temperatures at flowering result in production of sterile pollen or premature flower fall. This may be a reasonable explanation for the reduction of capsules in late sown plants observed in this study. Also, Ahmed (1998) reported that early sown sesame produced significantly more capsules than the late sown crop. The superiority of Promo to Khidir in number of capsules per plant was previously reported by Ahmed (1998).

Sowing date had a highly significant effect on mean number of seeds capsule^{-1}. In both seasons, mid June sowing gave the highest number of seeds per capsule (Table 3). However, like the number of capsules per plant, no significant differences in mean number of seeds capsule^{-1} were obtained between the other four sowing dates in the second season, suggesting that this trait had greater plasticity. Plants of Promo produced significantly more seeds capsule^{-1} than those of Khidir in the first season. The production of more seeds capsule^{-1} by the early sown plants (15/6) might be due to the proper utilization of the more favourable climatic conditions and to the production of sufficient assimilates during the seed filling, as reported by Weiss (2000). Variability in the number of seeds per capsule between the two cultivars might be due to genotypic factors as stated by Padmavathi and Thongavelu (1996). The 1000-seed weight tended to decrease as sowing was delayed, and seeds of Khidir were heavier than those of Promo (Table 3). As stated before, days to maturation of sesame plants were greatly reduced when sowing was delayed to August, and the 1000-seed weight responded negatively to delayed-sowing. Seeds of late sown crop were of smaller sizes. This may be due to the reduction in the period of seed filling as reported by Ahmed (1998).

Table 3. Effect of sowing date and cultivars on seed yield and yield components of sesame plants grown under irrigation

Parameter	No. of capsules plant $^{-1}$		No. of seeds capsule $^{-1}$		1000-seed weight (g)		Seed yield (kg ha $^{-1}$)	
	2001/02	2002/03	2001/02	2002/03	2001/02	2002/03	2001/02	2002/03
Sowing date								
Mid June	80a	46a	70a	65a	3.7a	3.7a	1358a	877a
Early July	52b	30b	66a	60b	3.8a	3.8a	1091b	531b
Mid July	60b	28b	60b	58b	3.5ab	3.6ab	725c	356c
Early August	42bc	31b	58bc	62b	3.5ab	3.7a	361d	467bc
Mid August	37c	29b	55c	60b	3.1b	3.3b	451d	418bc
LSD (5%)	11.4**	4.6**	4.8**	3.3**	0.5*	0.2*	145.1*	139.7*
Cultivar								
Khidir	49b	31b	59b	61a	3.6a	3.8a	678b	500a
Promo	59a	34a	65a	61a	3.4a	3.4b	917a	560a
LSD (5%)	6.6*	2.9*	2.7*	2.1	0.3	0.1*	83.8*	88.4

Means followed by similar letters in each column are not significantly different ($P \leq 0.05$), according to the least significant difference (LSD).

There was great influence of sowing date on sesame seed yield (Table 3). This may be attributed to the variation in temperature profile and photosynthetic active radiation within crop canopy as suggested by Nath *et al*. (2001). Mid June sowing significantly outyielded all other sowing dates, and the differences in seed yield between 15/6 and 15/8 sowings were 67% and 110% in the first and the second season, respectively. This may be attributed to low light intensity encountered by the late sown crops. The cultivar Promo outyielded Khidir by 25% and 11% in the first and the second season, respectively. Reports by previous workers (Khidir 1981; Osman 1985; Aslam *et al*. 1989; Ahmed 1998; El Mahdi *et al*. 2007) showed that the optimum sowing date for sesame in the rainfed areas of the Sudan, lies between mid June and mid July, and delaying sowing date to early August resulted in substantial yield reduction. The higher yields of early sown crop were due mainly to the production of more capsules plant^{-1} and greater number of seeds capsule^{-1} and to the relatively heavier seed. Desai *et al.* (1984) indicated that capsule number had the maximum direct influence on seed yield. The present findings are in agreement with those reported earlier

CONCLUSIONS

The cultural practices of sesame under irrigation need further investigation, and there is an urgent need to develop cultivars with high yield potential and better quality. Based on what has been reported in this study, it can be concluded that the optimum sowing date for sesame under irrigation in Kennana is mid June, and that the cultivar Promo seams to be more promising than the cultivar Khidir.

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تاثير ميعاد الزراعة على اداء محصول السمسم تحت الري

فيصل القاسم أحمد وآمنه أحمد عبد الله[1] ومحمد مصطفى عمر[1]

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موجز البحث: أجريت دراسة لمعرفة تأثير ميعاد الزراعة (6/15 ، 7/1 ، 7/15 ، 8/1 و8/15) على فينولوجى وانتاجية صنفين من محصول السمسم تحت الري خلال موسمين متتاليين (02/2001 و 03/2002). أظهرت النتائج أن الزراعة المبكرة (منتصف يونيو) أخذت فترة زمنية أطول معنويا للوصول إلى 50% إزهار و للنضج الفسيولوجي مقارنة بالزراعة المتأخرة (منتصف أغسطس) في كل من الموسمين . لم تختلف الأصناف معنويا فى عدد الأيام إلى مرحلة 50% إزهار . تأثرت الإنتاجية من البذور ومكونات الإنتاجية معنوياً بمعياد الزراعة حيث حقق موعد الزراعة المبكر 100% و 75% زيادة فى الإنتاجية مقارنه بالزراعة المتآخره فى العام الاول والعام الثانى على التوالي. وكانت الإنتاجية العالية للزراعة المبكره مصحوبه بزيادة فى عدد العلييات وعدد البذور فى العليبة ووزن البذور . تفوق الصنف برومو على الصنف خضر فى الانتاجية وعدد العلييات وعدد البذور فى العليبة خاصة فى الموسم الأول. على ضوء نتائج هذه الدراسة يمكن الإستنتاج بأن انسب موعد لزراعة السمسم المروي في منطقة كنانه هو منتصف يونيو وإن الصنف برومو أفضل من الصنف خضر.

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