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Performance of sesame (*Sesamum indicum,* L.) in southwestern Nigeria as influenced by rowspacing.

E.A. OGUNREMI,
Institute of Agricultural Research and Training,
University of Ife,
P.M.B. 5029, Moor Plantation,
Ibadan, Nigeria.

Abstract

Experiments were conducted in two ecological zones in Nigeria during 1977 and 1978 to investigate the influence of inter-row spacing on growth, development and yield of sesame (*Sesame indicum,* L.). 16 treatments, consisting of two cultivars (Yandev 55 and $65^{A} - 36$) and eight row-widths (7.5, 15.0, 22.5, 30.0, 37.5, 45.0, 52.5 and 60.0cm) were tested in a randomised complete block design with four replications. Leaf area, dry matter production and yields were significantly influenced by inter-row spacing. Dry matter accumulation increased with increase in inter-row spacing. Seed and oil yields increased with inter-row spacing up to 37.5cm. Greater dry matter was diverted into the capsules of plants grown in 37.5cm rows. Cultivar $65^{A} - 36$ was significantly better with a mean yield of 428 kg/ha than Yandev 55 which gave 360 kg/ha. Seed production efficiency was higher by 8% in cultivar $65^{A} - 36$ than in Yandev 55. The growth analysis suggested that the green capsules contributed towards the accumulation of their dry matter.

Introduction

Besides being a valuable source of vegetable oil, sesame *(Sesamum indicum,* L.) is an important source of protein, with the seeds of some having 22-24% protein content (Tsatsaronis *et. al.,* 1971). In Nigeria, sesame has been a traditional crop of great importance in Igbirra and Kwali areas of Kwara State, and is being grown extensively both for export and home consumption in Benue State. Its distribution has been comprehensively reviewed by Van Rheenen (1973). In southwestern Nigeria, it is a recent introduction as a potential and alternative source of vegetable oil and Ogunremi (1979) has showed that it could be profitably cultivated in the lowland rainforest and savanna areas. However, to ensure maximum profitability to farmers in these zones, greater research efforts into aspects of sesame cultivation are required.

Inter-row spacing, among others, is an important aspect of sesame cultivation. It varies greatly with sesame crop types and ecological zones. For instance, Nye (1940) in East Africa reported that closer row-width envouraged more even growth and uniform ripening of sesame. Tribe (1967) on the other hand, recommended inter-row spacing of 23 to 30cm for non-branching and 32 to 66cm for branching cultivars. Leakey (1970) recorded best yields in rows 35.5cm apart. Mazzani and Cobo (1958) in middle and south America found that a reduction of the row-width from 70 to 30cm resulted in 39% increase in seed yield, while Narain and Srivastava (1962) in India obtained their best seed yield at an inter-row spacing of 31cm. In northwestern Nigeria, Van Rheenen (1973) recommended an inter-row spacing of 22cm and intra-row spacing of 13.5cm for maximum yield. He found that the most significant yield increase was obtained by reducing inter-row rather than intra-row spacing. Considering the variations reported in the preceding paragraph, this study was conducted to determine the optimum inter-row spacing for sesame cultivation in southwestern Nigeria.

Materials and Methods

The experiments were carried out during the late cropping season of 1977 and 1978. The locations were Ibadan in the low-land rain-forest zone at the Institute of Agricultural Research and Training (7^o 22½'N, 3^o 50½'E) and Ilora (7^o 45'N, 3^o 52½'E) in the derived savanna zone. Preliminary soil analysis at the start of the study showed that the Ibadan soil, derived from coarse grained granites and gneisses of Apomu series (Moss, 1957), ranged from pale greyish brown to dark reddish in colour. It was slightly clayey sand to very clayey sandstones with some concretions below 50cm. Ilora soil was mostly of colluvial material derived from basement complex ; it was sandy down to 50cm, and light to dark brown in colour. The mean annual rainfall during the experimental period was 1320.8mm at Ibadan and 1152.4mm at Ilora.

The treatments consisted of two sesame cultivars – Yandev 55 and 65^A -36 and eight row spacings – 7.5, 15.0, 22.5, 30.0, 37.5, 45.0, 52.5 and 60.0cm. Intra-row spacing was kept constant at 13.0cm for all experiments. The 16 treatments were tested in a randomised complete block design with four replications. The gross plot size was 5 x $5m^2$ and the net plot was 3 x $3m^2$. Planting was done by hand in the third week of July at the rate of 2 – 4 seeds per hill at a depth of about 2cm. The plants were thinned to one per hill a week after planting, and were

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Results and Discussion

Seedling growth and leaf area development

At two weeks after planting, plant in narrow rows were smaller than those in wider rows. Plants grown in 30cm rows had the largest leaf area (Fig. 1) but from four weeks onwards plants in 37.5cm rows produced the largest leaf area.

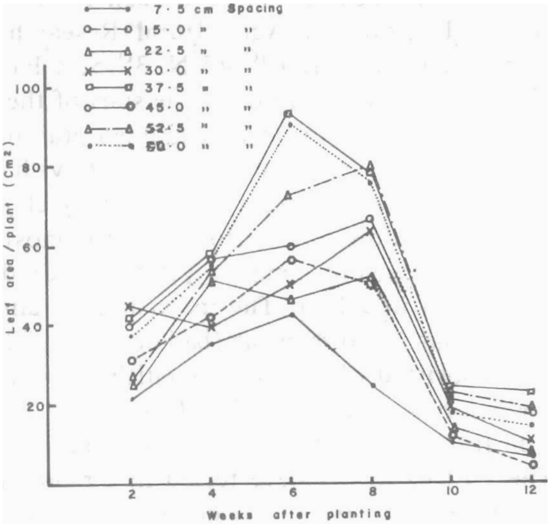

Fig. 1: Effect of row spacing on leaf area.

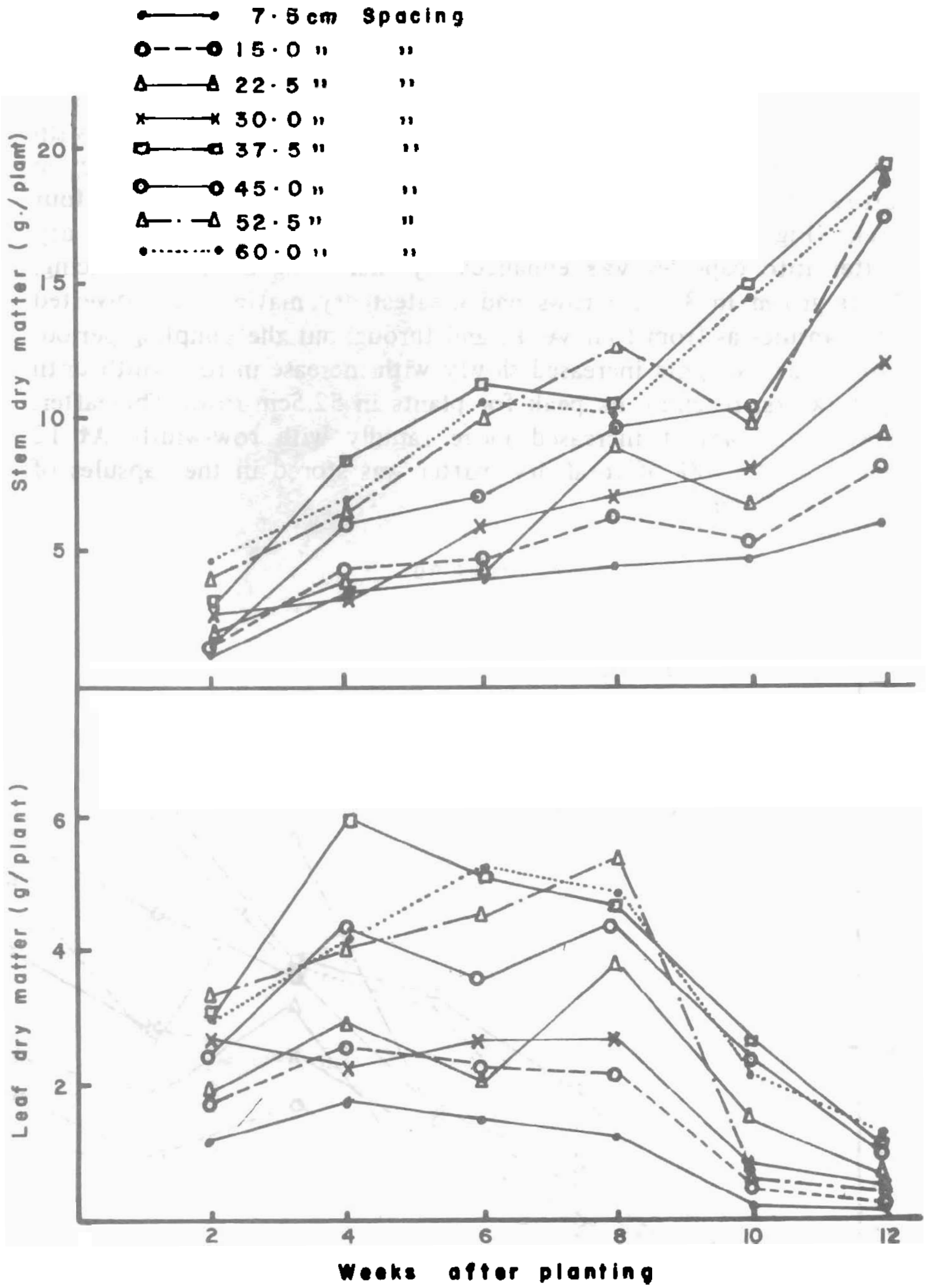

Fig. 2: Effect of row spacing on leaf and stem dry matter.

Dry matter production

Figures 2 and 3 show that dry matter production generally increased significantly with increase in row spacing, the highest being produced by plants grown in 37.5cm rows. Dry matter production increased with age in all treatments but the rate of increase was faster in wide than in narrow rows (Fig. 3). Leaf dry matter started decreasing after four weeks (Fig. 2) due to senescence. Fig. 4 shows that diversion of dry matter into capsules was enhanced by increasing inter-row spacing. Plants grown in 37.5cm rows had greatest dry matter being diverted into capsules as from four weeks and throughout the sampling period. Capsule dry weights increased slowly with increase in row-width until eight weeks, reaching its peak for plants in 52.5cm rows. Thereafter, capsule dry weight increased more rapidly with row-width. At 12 weeks, up to 56% of total dry matter was stored in the capsules of plants in 37.5cm rows.

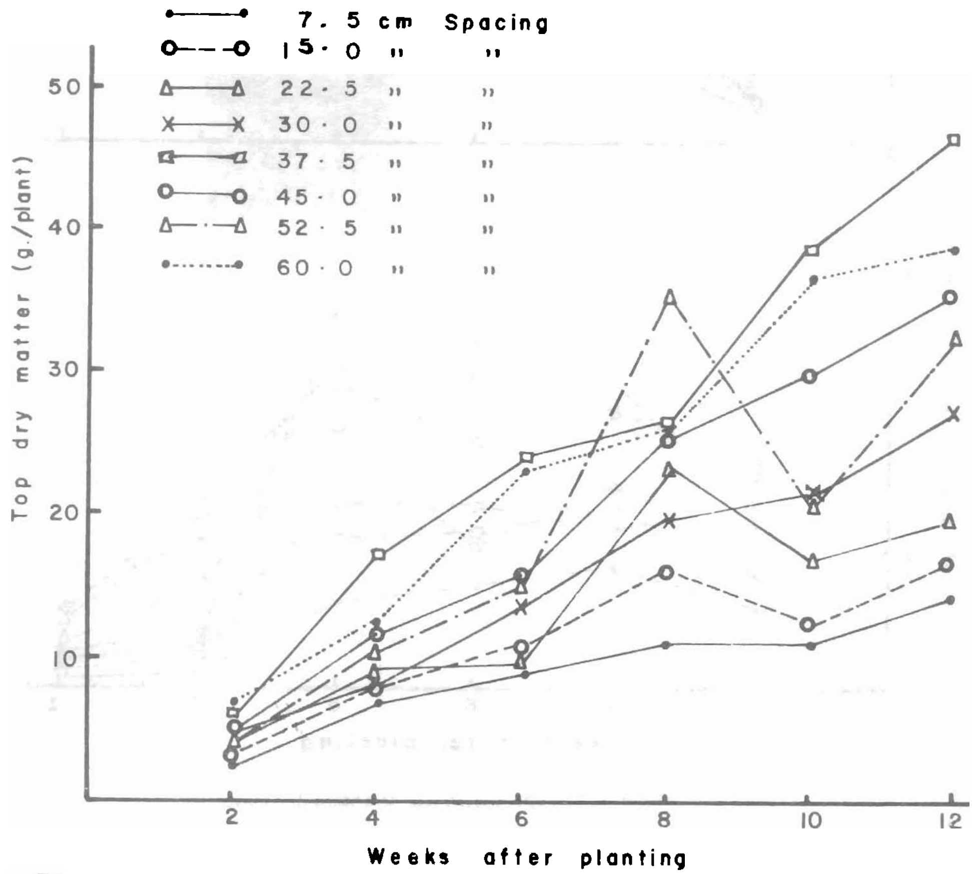

Fig. 3: Effect of row spacing on top dry matter.

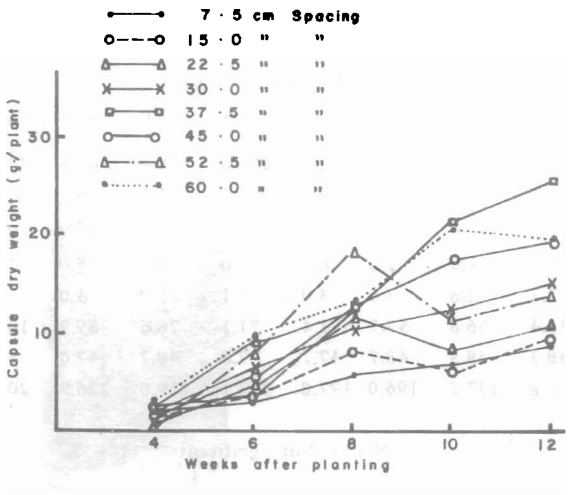

Fig. 4: Effect of row spacing on capsule dry weight.

Seed yield, oil yield and yield components

Yield and yield components are summarised in Tables 1 and 2. Effect of row spacing was significant. Seed and oil yields increased significantly with row spacing up to 37.5cm beyond which no significant changes in yield were observed (Table 1). Number of capsules produced, number of branches per plant, seed size and plant height were also significantly influenced by row spacing. Increased oil yield occurred with increased spacing but resulted from increased seed yield rather than increased oil content of individual seed. There were significant location and cultivar effects on seed yield and some yield components. Generally, yields were higher at Ibadan in the rainforest than at Ilora in the savanna. Also cultivar 65^{A} – 36 was 19% higher yielding than Yandev 55. Nonetheless, the influence of row spacing was consistently evident and similar for both cultivars at both locations. Cultivar 65^{A} – 36 which branched more profusely than Yandev 55, produced less proportion of its total number of capsules on the main stem at wider row spacing. The ratio of seed weight: capsule weight expressed as percentage, was computed to estimate the crop seed production efficiency (SE). It differed significantly between both cultivars (Table 2), but was not affected by row spacing.

The results confirm that the performance of sesame could be greatly influenced by row spacing. It was shown that for a branching cultivar, an inter-row spacing of 37.5cm gave optimal yields. This agrees with

TABLE 1 – EFFECT OF ROW SPACING ON SEED YIELD AND GROWTH PARAMETERS IN SESAME

Parameter	Row Spacing (cm) 7.5	15.0	22.5	30.0	37.5	45.0	52.5	60.0	Mean	S.E. ±
Seed yield (kg/ha)	233.3	294.1	411.5	427.9	515.8	478.4	502.6	438.0	412.7	32.8
Seed Wt. (g/plant)	1.4	2.1	4.6	4.3	7.7	5.9	9.2	9.2	5.6	1.0
Capsule No/plant	15.0	26.0	40.0	41.0	50.0	48.0	56.0	65.0	43.0	3.3
Branch No/plant	2.0	3.0	5.0	8.0	12.0	14.0	15.0	16.0	9.0	0.5
Wt/100 Seeds (g)	2.7	2.8	3.0	3.0	3.1	3.0	3.0	2.9	2.9	0·
Plant height (cm)	43.4	56.8	57.7	71.4	71.1	76.6	89.9	102.6	71.2	5.6
% Oil content	48.3	48.5	48.7	47.7	47.8	48.7	47.0	48.6	48.1	N.S.
Oil.yield (kg/ha)	106.8	137.2	196.0	197.8	242.1	229.8	226.9	207.8	193.1	22.5

N.S. = Not Significant

TABEL 2 – MEANS OF SEED YIELD AND SOME GROWTH PARAMETERS IN THE TWO SESAME CULTIVARS TESTED

Cultivar	*Seed yield (kg/ha)*	*Seed Wt. (g/plant)*	*Stem Capsule per plant (%)*	*Branch No/plant*	*Wt/100 seeds (g)*	*Seed Wt: Capsule wt (SE)*
Yandev55	256.2	2.8	83.6	10.0	2.6	29.4
65A–36	300.2	4.0	41.8	27.0	3.1	37.4
S.E. ±	14.5	0.3	1.5	1.8	0.03	1.4

(SE) = Seed production efficiency

Tribe's (1967) recommendation of 32-66cm in East Africa but differs from Van Rheenen's (1973) recommendation of 22cm for maximum yield. In this work, row spacing appeared mainly to influence the number of branches per plant, which decreased sharply in narrow rows probably because of overcrowding. Wide row spacing increased seed yield by increasing number of branches per plant as well as seed weight.

King *et al.*, (1967), observing that developing kernels became the predominant metabolic sink following anthesis in wheat, reported that the presence of the reproductive sink stimulated the photosynthetic activity of the leaves with photosynthate being rapidly translocated into the grain. Patterson and Moss (1979) found that the formation of kernels in wheat coincided with the onset of canopy senescence. Results of growth analysis in this work similarly showed that capsule growth coincided with leaf senescence but there was no indication that the presence of the capsules stimulated photosynthetic activity of the leaves. Although photosynthesis was not measured, the rapid growth of the green capsules while the leaf area was declining, would suggest that the capsules contributed towards accumulation of their dry matter.

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