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# Response of Seed Yield and its Components with relationship in Two Irrigated Sesame (*Sesamum indicum* L.) Cultivars to Varying Sowing Dates

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**Abstract:** Choosing an appropriate sowing date for a crop is one of the most important factors in its production when it is cultivated for the first time in a region. In order to study the effect of sowing date on Seed Yield and its Components, two sesame cultivars, an experiment was conducted as factorial with randomized complete blocks design with four replications at Faculty of Agriculture , Kassala University during 2014/2015 and 2015/ 2016 seasons in the Halfah Elgadidah, Sudan . Experimental factors including: four sowing dates (S1, S2, S3 and S4) corresponding to 1rst Nov,15th Nov, 1rst Dec and 15th Dec and two diverse sesame cultivars "Promo" V1, Um shagara as local cv V2. The results showed that both cultivar and sowing date had significant effects on biological yield, leaf area, number of branches and pods per plant, 1000-seed weight and Seed yield ($V_1$) had a significantly greater biological and seed yield per plant than (V2**)** particularly when sown during S3 but V2 had greater leaf area, number of branches per plant and seed yield per unit area during S3. Also, significant strong positive correlation between biological yield and yield components indicated the increased in seeds weight per plant. Therefore, it is recommended that local cultivar Umshagara sown on first Dec. for improved biomass productivity under irrigation in the study area.
**Keywords**: Sesame, sowing dates, cultivars, leaf area, phonology and yield

## INTRODUCTION

Sesame (*Sesamum indicum* L.) belongs to family pedaliaceae. It is an annual, self-pollinated and indeterminate minor kharif oilseed crop. Sesame is an ancient oil crop supplying seeds for confectionery purposes, edible oil, paste (tahini), cake and flour. It is an important oil seed crop in the world. Its grain is an excellent source of high quality oil, protein, carbohydrate, calcium and phosphorus [1]. According to [2] it is typically a crop of small farmers in the developing countries. Sesame is considered as a drought tolerant crop. The Sudan occupies the third rank as world producer, nevertheless it is considered as the first world exporter of sesame seeds [3]. The annual production of the Sudan amounts to 13.5% of the total world production and about 50% of the African production [4].Crop duration is one of the major factors limiting crop growth and productivity in sesame [5].The grain yield of sesame is significantly influenced by sowing date and cultivars [6]. Moreover, temperature and variety affected seed yield variation by 69 and 39%, respectively [7]. According to [8] delaying of sesame sowing increased the incidence of pests and diseases. Therefore, for successful production of crop most optimum sowing time and cultivars are indispensable [9]. Delay in sowing decreases yield drastically [4]. The effect of photoperiodism on sesame has been thoroughly studied, since this is a major factor influencing biological yield [10]. Variation among sesame genotypes in morphological characters have been observed by [11] who indicated the presence of considerable amount of variation among sesame genotypes in plant height leaves number, number of branches, number of nodes per plant and dry matter production. This might explain the consistent differences between the tested cultivars in all growth parameters measured in this study. Also, [12] in Sudan, found that yield per plant was significantly and positively correlated with stem height, number of branches, number of pods, pod length, seeds per pod, seeds per plant and 1000 seed weight.

The country currently is importing vegetable oils for the local consumption, thus the improving of local oil crop will cut these imports and help in the self sufficiency of such vital commodity. Also, the protein balanced meal will be of great significant for the dairy and poultry industries. Moreover, efforts are now underway in Sudan to encourage the cultivation of oil seed crops to meet the domestic need as well as to earn the foreign exchange. Consequently, among different factors, cultivars (yield stability) emerges at a serious

threat to low productivity of oil crops for farmers in Kassala state eastern Sudan for the past few years. Therefore, the best option for sesame production, yield improvement and yield stability under varying sowing dates is using specific high yielding sesame cultivars. In view of the above reasons it was imperative to conduct experiment involving two sesame cultivars with regard to their response to varying sowing dates in winter season in order to obtain the potential seed yield of these cultivars. Also, we would expect no certain variety would be suitable alone for these areas. These factors interrelate providing an important insight to the study of interactive effect of sowing dates on two soy bean cultivars in Halfa Elgadidah area as irrigated crop.

## MATERIALS AND METHODS

A field experiment was conducted for two consecutive seasons (2014/015 and 2015/016) in the Demonstration Farm of the Faculty of Agriculture and Natural Resources, University of Kassala, Halfa Elgadidah, Sudan (Latitude 15° 19′ N. Longitude 35° 36′E and Altitude 45 m *asl*). The main objective of this study is to study the response of seed yield and yield components in two sesame (*sesamum indicum* l.) cultivars to varying sowing dates. The two sesame cultivars: Promo (V1) and Umshagara (V2); were used in this study. The four sowing dates are designated as S1, S2,S3 and S4 corresponding to 1rst Nov,15$^{th}$ Nov, 1rst Dec and 15$^{th}$ Dec, respectively. The experiment was arranged in Randomized Complete Blocks Design with four replications. The land was prepared as recommended by Agricultural Research Corporation.

**Characters studied:**

Ten plants were randomly selected and tagged in each plot to determine the following growth parameters: biological yield per plant (g), leaf area (cm$^2$) and number of branches per plant.

**Total biological yield per plant** (g): The completely matured plants were uprooted carefully along with roots and were dried completely. The weight of dried plant along with capsules was recorded as biological yield in grams.

**The leaf area** was calculated from the following relationship:

$$\text{Leaf area} = \frac{\text{Total area of leaf discs x Total dry weight of leaves}}{\text{Dry weight of leaf discs}}$$

**Yield attributes:** At maturity, an area of 1m$^2$ was selected randomly in each plot and used to determine the seed yield (kg ha$^{-1}$). Ten plants from each plot were randomly selected and the average pod length (cm), number of pods, seeds per pod, seeds weigh (g) per plant and 1000-seed weight (g) were determined. Also, harvest index was calculated as follows:

$$\text{Harvest index} = \frac{\text{Economical yield (Seed yield/plant) x 100}}{\text{Biological yield (Shoot dry weight)}}$$

Data were statistically analyzed according to the analysis of variance (ANOVA) for RCBD using MSTAT-C computer software package [14]. Mean comparisons were worked out by Duncan's Multiple Range Test (DMRT) at 5% level of probability.

## RESULTS AND DISCUSSION

Data shown in Table 1 represented mean of biological yield, number of branches per plant and leaf area traits. From the obtained results, the differences due to sowing dates were significant**.** In this regard**,** the heavier plants with highest number of branches were recorded in plots sowing on first Dec. (S3) but the greater values of leaf area were recorded in plants sown on 15$^{th}$ Dec. (S4)**.** Regarding cultivars**,** Promo ($V_1$) had a significantly greater biological yield than Umshagara (V2**)** particularly when sown during S3 but V2 had greater values of leaf area and number of branches per plant (Table 1). This difference may be due to their genetic as well as phenotypic difference form local cultivar. It was observed that the second season (2015/2016) showed higher biological yield as a result of relatively higher number of branches per plant and greater leaf area. These results are in line with those[10] who reported that recommended sowing date produced taller plants and more number of branches plant$^{-1}$ and increased vegetative growth of plant under favorable weather as a resulted more biological yield as compared to early and late sowing time.

The results presented in tables (2 and 3) also, showed that, sowing sesame during S2 significantly increased (yield attributing characters) pod length, number of pods, number of seeds per pod, seeds weight per plant,1000-seed weight and seeds yield (kg ha$^{-1}$) as compared with other sowing dates. Although the tow cultivars were as par in the most these traits but V1 out yielded V2 in seed weight per plants. In contrast, the V2 out yield V1 in the seed yield per unit area. Likewise, harvest index significantly increased during S2, this might be due to the increased in seed yield per plant Similar positive responses of harvest index of sesame plant to time of planting and cultivars was reported by [10]) who reported that, this could be due to difference in genetic makeup of crop plants, varying date of sowing and climatic condition. Also,[9]reported that harvest index significantly influenced by date of sowing. The positive effects sowing dates on increasing seed yield and yield components measured in this study could be attributed partly to the variation in the weather factors across planting dates**.** Similar results were reported by [15] who stated that the increase in aforementioned characters could be due to genetic makeup and climatic conditions. Also, these finding s were agreements with those reported by [16] who indicated that sesame varieties were significantly

different in seed yield as temperature variation during the growth period and concluded that the temperature variation contributed with 39% in seed yield variation. Furthermore, Tables 4 and 5 indicated that there were significant strong positive correlation between biological yield with leaf area, number of (branches, pods, seeds per pod and seeds yield) per plant and test weight (1000-seed weight). Also, the significant strong positive correlation between seeds yield per plant and aforementioned characters indicated the increased in seeds weight per plant. These result also corroborated with the findings of [12], in Sudan, who found that yield per plant was significantly and positively correlated with number of branches, number of pods, pod length, seeds per pod, seeds per plant and 1000-seed weight. Also, the relationship between biological yield and seed.

**Table 1: Effect of cultivars and sowing date on some growth traits of irrigated sesame**

| Season | | 2014/2015 | | | 2015/2016 | | |
|---|---|---|---|---|---|---|---|
| Treatments | | **Biological yield(g)** | **LA($cm^2$)** | **No. of branches/plant** | **Biological yield(g)** | **LA($cm^2$)** | **No. of branches/plant** |
| V1 | | 14.43 | 1107.7 | 2.88 | 43.53 | 1232.7 | 3.84 |
| V2 | | 12.00 | 1304.9 | 2.92 | 41.25 | 1417.4 | 4.02 |
| $LSD_{0.05}$ | | 1.85 | 138.86 | - | 14.51 | - | - |
| $S_1$ | | 11.52 | 800.5 | 2.71 | 39.11 | 975.0 | 3.49 |
| $S_2$ | | 13.85 | 1061.0 | 2.68 | 33.45 | 1048.5 | 4.66 |
| $S_3$ | | 16.11 | 1349.0 | 3.20 | 57.30 | 1349.0 | 4.01 |
| $S_4$ | | 11.41 | 1615.2 | 2.90 | 39.71 | 1927.7 | 3.56 |
| $LSD_{0.05}$ | | 2.62 | 196.37 | - | 20.52 | - | 0.62 |
| V1 | $S_1$ | 9.08 | 856.5 | 2.68 | 14.47 | 1306.5 | 3.38 |
| | $S_2$ | 16.68 | 764.7 | 2.73 | 36.47 | 889.7 | 4.65 |
| | $S_3$ | 16.11 | 1347.8 | 2.98 | 57.27 | 1597.8 | 3.93 |
| | $S_4$ | 15.86 | 1461.7 | 2.91 | 38.92 | 1136.7 | 3.43 |
| V2 | $S_1$ | 13.96 | 743.6 | 2.74 | 36.76 | 643.6 | 3.60 |
| | $S_2$ | 11.02 | 1357.2 | 2.63 | 30.42 | 1207.2 | 4.68 |
| | $S_3$ | 16.10 | 1350.1 | 3.43 | 57.33 | 1100.1 | 4.10 |
| | $S_4$ | 6.95 | 1768.8 | 2.90 | 40.49 | 2718.8 | 3.70 |
| $LSD_{0.05}$ | | 3.70 | 196.37 | - | 29.02 | - | - |

**Table 2: Effect of cultivars and sowing date on seed yield and yield components of irrigated sesame**

| Season | | 2014/2015 | | | | 2015/2016 | | | |
|---|---|---|---|---|---|---|---|---|---|
| **treatments** | | **No. Pods/plant.** | **pod length(cm)** | **No. seeds /pod** | **Weight of seeds /plant(g)** | **No. Pods/plant.** | **pod length(cm)** | **No. seeds /pod** | **Weight of seeds /plant(g)** |
| V1 | | 15.63 | 2.49 | 53.00 | 25.57 | 15.92 | 2.85 | 50.03 | 27.29 |
| V2 | | 15.13 | 2.47 | 52.59 | 18.80 | 17.60 | 2.64 | 52.47 | 22.29 |
| $LSD_{0.05}$ | | - | - | 4.96 | 2.46 | 1.43 | - | - | 11.28 |
| S1 | | 14.74 | 2.35 | 47.83 | 15.99 | 18.99 | 2.83 | 48.44 | 12.57 |
| S2 | | 16.64 | 2.52 | 51.30 | 30.17 | 20.44 | 2.73 | 57.64 | 28.67 |
| S3 | | 14.75 | 2.51 | 59.35 | 23.82 | 11.56 | 2.66 | 48.07 | 26.23 |
| S4 | | 15.58 | 2.54 | 52.65 | 18.77 | 16.04 | 2.77 | 48.07 | 31.60 |
| $LSD_{0.05}$ | | - | - | 7.01 | 3.67 | 2.02 | - | 12.18 | 15.95 |
| V1 | S1 | 13.93 | 2.30 | 49.03 | 18.14 | 21.25 | 3.04 | 49.23 | 12.52 |
| | S2 | 18.23 | 2.55 | 50.05 | 40.52 | 21.04 | 2.71 | 54.33 | 35.02 |
| | S3 | 13.22 | 2.56 | 62.48 | 22.79 | 11.24 | 2.77 | 45.10 | 30.29 |
| | S4 | 17.15 | 2.57 | 50.47 | 20.84 | 10.15 | 2.89 | 51.45 | 30.29 |
| V2 | S1 | 15.55 | 2.41 | 46.63 | 13.84 | 16.74 | 2.62 | 47.65 | 12.63 |
| | S2 | 14.70 | 2.50 | 52.55 | 19.82 | 19.84 | 2.74 | 60.95 | 22.23 |
| | S3 | 16.28 | 2.47 | 56.23 | 24.85 | 11.89 | 2.54 | 51.04 | 22.35 |
| | S4 | 14.00 | 2.51 | 54.83 | 16.70 | 21.93 | 2.64 | 50.23 | 22.35 |
| $LSD_{0.05}$ | | 3.40 | - | 9.92 | 4.92 | 2.86 | - | - | 22.56 |

**Table 3: Effect of cultivars and planting date on seed yield and yield attributes of irrigated sesame**

| Season | | 2014/2015 | | | 2015/2016 | | |
|---|---|---|---|---|---|---|---|
| **treatments** | | **1000-seed weight(g)** | **Seed yield(kg/ha)** | **Harvest index** | **1000-seed weight(g)** | **Seed yield(kg/ha)** | **Harvest index** |
| V1 | | 3.19 | 1442.9 | 33.25 | 3.15 | 1235.8 | 34.47 |
| V2 | | 3.38 | 1659.2 | 31.28 | 3.04 | 1220.8 | 34.35 |
| $LSD_{0.05}$ | | 0.20 | 214.21 | - | - | - | - |
| S1 | | 2.95 | 1246.5 | 28.26 | 3.11 | 1427.4 | 27.37 |
| S2 | | 3.41 | 1723.9 | 37.61 | 3.02 | 1419.0 | 37.35 |
| S3 | | 3.27 | 2252.8 | 29.17 | 3.14 | 1307.9 | 30.83 |
| S4 | | 3.52 | 981.0 | 34.03 | 3.14 | 758.9 | 41.86 |
| $LSD_{0.05}$ | | 0.28 | 302.94 | 6.40 | - | 195.70 | 4.44 |
| V1 | S1 | 2.75 | 1009.6 | 36.69 | 3.28 | 1449.0 | 32.07 |
| | S2 | 3.39 | 1383.8 | 40.86 | 3.22 | 1552.3 | 36.44 |
| | S3 | 3.33 | 2410.9 | 28.26 | 3.11 | 1206.4 | 31.64 |
| | S4 | 3.31 | 967.3 | 27.19 | 3.00 | 735.4 | 37.49 |
| V2 | S1 | 3.15 | 1483.5 | 19.83 | 2.92 | 1405.7 | 36.78 |
| | S2 | 3.43 | 2063.9 | 34.35 | 2.82 | 1285.6 | 36.78 |
| | S3 | 3.21 | 2094.6 | 30.07 | 3.18 | 1409.5 | 32.44 |
| | S4 | 3.72 | 994.7 | 40.86 | 3.22 | 782.4 | 33.13 |
| $LSD_{0.05}$ | | 0.39 | 428.42 | 9.05 | 0.33 | - | 6.28 |

**Table 4: Co-efficient correlation between some growth and yield components of sesame cultivars grown during vary sowing date**

| **2014/2015** | Pods No. | 1000-seed wt | Yield (kg/ ha) | Biological yield | physiological maturity | No. of branches | seeds weight/plant | Pod length |
|---|---|---|---|---|---|---|---|---|
| 1000-seed wt | $0.887^{**}$ | | | | | | | |
| Yield (kg/ ha) | $0.194^{NS}$ | $0.093^{NS}$ | | | | | | |
| Biological yield | $0.978^{**}$ | $0.890^{**}$ | $0.209^{*}$ | | | | | |
| physiological maturity | $0.806^{**}$ | $0.789^{**}$ | $0.007^{NS}$ | $0.794^{**}$ | | | | |
| No. of branches | $0.908^{**}$ | $0.844^{**}$ | $0.134^{NS}$ | $0.908^{**}$ | $0.801^{**}$ | | | |
| seeds wt plant | $0.979^{**}$ | $0.900^{**}$ | $0.192^{NS}$ | $0.991^{**}$ | $0.806^{**}$ | $0.915^{**}$ | | |
| Pod length | $0.970^{**}$ | $0.863^{**}$ | $0.208^{*}$ | $0.978^{**}$ | $0.810^{**}$ | $0.931^{**}$ | $0.974^{**}$ | |
| Leaf Aea | $0.779^{**}$ | $0.658^{**}$ | $0.327^{**}$ | $0.776^{**}$ | $0.485^{**}$ | $0.638^{**}$ | $0.760^{**}$ | $0.695^{**}$ |

**Table 5: Co-efficient correlation between some growth and yield components of sesame cultivars grown during vary sowing date**

| **2015/2016** | Pods No. | 1000-seed wt | Yield (kg/ ha) | Biological yield | physiological maturity | No. of branches | seeds weight/plant | Pod length |
|---|---|---|---|---|---|---|---|---|
| 1000-seed wt | $0.928^{**}$ | | | | | | | |
| Yield (kg/ ha) | $0.903^{**}$ | $0.943^{**}$ | | | | | | |
| Biological yield | $0.782^{**}$ | $0.870^{**}$ | $0.812^{**}$ | | | | | |
| physiological maturity | $0.929^{**}$ | $0.993^{**}$ | $0.945^{**}$ | $0.876^{**}$ | | | | |
| No. of branches | $0.868^{**}$ | $0.925^{**}$ | $0.911^{**}$ | $0.782^{**}$ | $0.921^{**}$ | | | |
| seeds wt plant | $0.698^{**}$ | $0.789^{**}$ | $0.741^{**}$ | $0.660^{**}$ | $0.786^{**}$ | $0.742^{**}$ | | |
| Pod length | $0.929^{**}$ | $0.984^{**}$ | $0.929^{**}$ | $0.898^{**}$ | $0.989^{**}$ | $0.922^{**}$ | $0.771^{**}$ | |
| Leaf Aea | $0.921^{**}$ | $0.896^{**}$ | $0.910^{**}$ | $0.747^{**}$ | $0.897^{**}$ | $0.864^{**}$ | $0.594^{**}$ | $0.906^{**}$ |

## CONCLUSION AND RECOMMENDATIONS

From present study it can be concluded that local cultivar Umshagara sown on, 15th Nov. And first Dec. improved number of branches plant$^{-1}$ and biological yield, significantly and therefore, it is recommended that local cultivar Umshagara sown on first Dec. for improved biomass productivity under irrigation in agro-climatic condition of Halfa Elgadidah.

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