EVALUATION OF SOME SUNFLOWER CULTIVARS GROWN UNDER THREE PLANT DENSITIES

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ABSTRACT

Four hybrid cultivars of sunflower were tested for growth cheracters and productivity under three plant densities at the Experiment and Research center of the Faculty of Agriculture at Moshtohor, Zagazig University in 1990 and 1991 seasons. Cultivars were Alia, Pioneer 452. Pioneer 6431 and Pioneer 552. Plant stands/fad were 35000 (D1), 23333 (D2) and 17500 (D3). Resullts showed significant to highly significant differences among cultivars in plant height, number of leaves/plant, head diameter and lodging percentage. Pioneer 6431 and Pioneer 552 were associated with high percentages of lodged plants. Also, high percentage of empty heads were associaled with Pioneer 6431 and Pioneer 552. However, the three cultivars of Pioneer gave significantly higher weight per head and achenes/head than Alia. Pioneer 552 excelled other varieties in 100-achene weight. As for yield of heads/fad, achenes/fad, Alia excelled other cultivars in both traits. Oil percentage showed no significant differences, however, oil yield for alia was significantly the highest.

Results on stands show that some growth characters differed significantly with stand. Plants grown under (D3) were shorter, of thicker stem, less ability to lodge and gave less empty heads. Weight of head, and achenes/ head were superior under (D2). However, the highest head/yield, achenes yield/fad and oil yield/fad were those obtained from (D1).

The interaction of dinsity x variety was significant for the characters empty heads Percent, head weight achenes/ head 100-achene weight yield/fed and achene yield/fad.

INTRODUCTION

Many investigations are in favor of increasing inter-and intra-spacings between plants, that is low plant density per unit area. Curotti and Rosania (1971) and Mekki (1984) have shown that under low densities, plants were shorter , thicker in diameter, and maintained more leaves (Nour El-Din et al., 1983 a).

Lodging percentages were reported to increase under narrow spacing (high stand) in comparison with wide spacing (low stand) (Swallera and Fick, 1973).

Reductions in the weight of heads and achene/head were reported in high plant stands (Struma, 1970; and Nour El-Din et al., 1983 b).

Higher yields,i.e, achene yield/ plant and achene yield/unit area were significantly higher with wide spacings (Nour EI-Din et al.,1983b; Ahmed, 1977; Mekki, 1984; Attia, 1980; and Zubriski and Zimmerman, 1974). No significant differences were reported for oil percentage due to plant density (Ahmed, 1977). On the contrary, oil content of seed was reported to increase with wide spacing and low density (Curotti and Rosania, 1971; and Ahmed , 1977) . Oil yield, nevertheless was higher with narrow spacings (high density) than wide spacings (low density) (Karami, 1977; and Jessop, 1977).

This work was intended to evaluate some sunflower cultivars under three plant densities for some growth, yield and yield components .

MATERIALS AND METHODS

Two field experiments were carried out in agricultural and Experiment Center of the Faculty of Agriculture at Moshtohor in the two seasons of 1990 and 1991. Soil type of the farm is clay loam of pH value 8 and organic matter content of 2%.

The experimental design utilized was the completely randomized block with four replications. Each experiment included twelve treatments. These were the combination of three plant denisities and four cultivars. Plant densities of 35000, 23333 and 17500 plants/ fad designated as D1, D2

and D3 were utilized which are equivalent to spacing plants at 20, 30 and 40 cm the ridges. Cultivars were the four hybrids ,Alia "Franssy" Pioneer 452, Pioneer 6431, and Pioneer 552. Alia is a tall cultivar, the three Pioneers are of medium height. Sowing took place on the 5 th and the 11th of July for 1990 and 1991 seasons, respectively. Hills were thinned to one plant prior to the first irrigation. Plots were fertilized the same with superphosphate and nitrogen fertilizers at the rates of 30 kg/P_2O_5 /fad and 60 kg/N /fad, respectively. In both seasons the preceding crop was clover.

All plots were treated the Same as recommended for the crop unless otherwise stated.

Data recorded:

Data obtained included the following measurements:

1 - Plant height(cm).
2 - Number of green leaves/plant.
3 - Stem diameter/mm just under the head.
4 - Head diameter (mm).
5 - Lodging percentage of plants.
6 - Percentage of barren heads.
7 - Head weight (g).
8 - weight of achenes/head (g).
9 - Weight of 100 achenes/g.
10- Head yield/fad. (kg).
11- Achene yield/fad (kg).

Oil determination :

Oil percentage of seeds was determined using Soixhelt apparatus and the solvent petroleum either (40-60%) according to A.O.A.C. method (Anonymous, 1975).

Statistical analysis:

Pooled data over the two seasons were subject to the appropriate analysis of variance according to (Snedecor, 1956). L.S.D. at the 5% and 1% levels of significance were used to compare among means.

RESULTS AND DISCUSSIONS

1) Performance of varieties in growth characters :

Overall means (Table, 1) show that the tested varietes were significantly different in plant height, number of leaves/ plant, head diameter and lodging percentages ($P>.01$). The variety Alia was the tallest of all however

Table(1): Mean performance of sunflower cultivars (Averages of 1990 and 1991 seasons).

Character / Cultivars	Plant height cm.	No. of leaves plant	Stem diameter m.m.	Head diameter cm.	Lodging %	Barren heads %	Wt. of head/gm		Wt. of 100 achenes g.	Head yield/fad. kg.	achene yield/fad. kg.	Oil %	Oil yield/fad. kg.
							Total	achenes					
Alia	147.62	12.88	14.98	19.14	8.87	6.23	128.24	71.79	8.02	2646.12	1491.51	40.17	599.14
Pioneer 452	128.09	14.16	15.67	18.88	7.97	7.16	144.42	83.79	8.37	2380.98	1387.71	39.61	549.67
Pioneer 6431	119.38	13.51	15.25	18.32	26.94	9.46	141.33	76.44	8.22	2444.87	1310.73	41.01	537.55
Pioneer 552	122.67	14.89	15.38	19.54	16.10	8.19	156.45	88.66	9.47	2116.58	1199.89	41.89	502.64
L.S.D. 0.05	6.83	1.08	N.S	0.87	4.17	2.34	5.00	5.85	0.40	195.07	120.13	N.S	55.84
L.S.D. 0.01	9.65	1.53	N.S	N.S	5.89	N.S	7.07	8.28	0.57	275.75	169.81	N.S	78.94

maintained significantly less number of leaves than the other three counterparts. The two biggest head diameter were those of Pioneer 552 and Alia.

With regard to stem diameter, no significant differences could be observed among the four cultivars.

The highest lodging percentage encountered was that of Pioneer 6431 (26.94%) followed by Pioneer 552 (16.18%). These two cultivars were significantly different in this respect than Alia and Pioneer 452 which were about equal in lodging percentages.

These two varieties were also associated with higher percentages of barren heads.

The three designated pioneer varieties were apparently of better head weight and better achene weight/head than Alia. However, the latter outyielded the three Pioneer varieties in the yield of heads/fad and achene yield/fad. Data show clearly that Alia was the lowest in 100-achene weight.

Apparently, the high yield of Alia could be attributed to its lower percentage of barren heads.

No varietal differences could be detected in percent oil however, differences in oil yield/fad existe and are primarly due to difference in achene yield/fad as could be seen from the highest yield of oil given by Alia.

11) Effect of density :

Overall means in Table (2) show that some characters were affected significantly by plant density. These were stem diameter, Percent of barren heads, lodging percent, head weight, achene weight/head, yield of head/fad achene yield/fad. and oil yield/fad.

It is clear that under the two densities (D1 and D2) plants were significantly taller and thinner than their counterparts from the low density (D3). Lodging percentages varied with density. The lowest lodging percent encountered was that associated with the lowest density (D3). With regard to the percent of empty heads, the highest percent was that associated with the highest density (D1) then decreased progressively in a manner suggestive of a clear tendency of percent baren heads to increase with density.

Table(2): Impact of Density on some major characters of sunflower cultivars (Averages of 1990 and 1991 seasons).

Character / Plant density /fad.	Plant height cm.	No. of leaves plant	Stem diameter m.m.	Head diameter cm.	Lodging %	Barren heads %	Wt. of head/g.		Wt. of 100 achenes g.	Head yield/fad. kg.	seed yield/fad. kg.	Oil %	Oil yield/fad. kg.
							Total	Achenes					
D_1 35000	132.32	13.92	14.25	18.57	14.95	9.10	136.42	75.57	8.44	2545.25	1422.44	40.98	582.92
D_2 23333	131.80	13.88	15.53	19.36	17.52	8.79	152.17	83.78	8.53	2497.89	1373.83	40.31	553.79
D_3 17500	124.20	13.78	16.18	18.98	12.44	5.39	139.24	81.16	8.59	2148.26	1240.16	40.72	507.44
L.S.D. 0.05	5.91	N.S	1.03	N.S	3.61	2.05	4.33	5.07	N.S	168.94	104.03	N.S	48.36
L.S.D. 0.01	N.S	N.S	1.4	N.S	N.S	2.88	6.12	N.S	N.S	238.81	147.05	N.S	N.S

Weight of head/g. varied significantly with density (P > 0.05 and 0.1). The highest total head weight and achene/head were unexpectedly associated with the second density (D2) and with the third (D3) which accomodated the least number of plants.

Both 100- achene weight and oil percent were not significantly variable among densities.

Head yield/fad. and achene yield/fad were both highly variable among densities. Results of the two characters show that increments in both characters were more or less parallel with increments in density. The highest two yields were those associated with (D1) and then reductions in yields ensured with reductions in densities. The amount of oil yield was also variable among densities. Variability is likewise due to variability in achene yield/fad in that oil percentages were large stable over the three densities.

III) Effect of the interaction between varieties and density:

Table (3) shows that barren heads, weight of whole head, Weight of achenes/head, weight of 100 achenes, heads yield/fad and achene yield/fad were significantly affected by the interaction of variety x density. Data show clearly that both Pioneer 6431 and Pioneer 554 tended to give higher percentages of empty heads with increased densities (D1 and D2) than their two counterparts alia and Pioneer 452. The total weight/head is excptionally higher with (D2) for all cultivars tested. The same trend is also noticeable with the weight of achene/head with a minor deviation, that is Pioneer 6431 gave higher weight for achene/head than the other three cultivar.

As for the weight of 100 achenes, the character is mostly stable for all varieties over all densities. Exception from that was the weight of 100 achenes of Pioneer 452 which was tangibly higher for (D3) than (D1 and D2).

Head yield/fad for all varieties coincided well with density, that is, higher yields were concomitant with higher densities (D1 and D2) and this is obvious with the three varieties.

Achene yield/fad. also, followed the same pattern as the previous ons except for Pioneer 6431 where, on the contrary, the highest yield was obtained from the least density (D3).

Table (3): Effect of the interaction of varieties x plant density on some characters of sunflower (Averages of 1990 and 1991 seasons).

Character / Variety X Density	Barren head %	Wt. of head/g.		Wt. of 100 achenes/g.	Head yield/fad kg	Achene yield/fad kg.
		Total (g.)	Achenes (g.)			
Alia D_1	7.24	118.40	69.54	8.45	2940.77	1727.11
Alia D_2	6.79	137.96	77.38	7.91	2987.23	1675.54
Alia D_3	4.66	128.36	68.45	7.70	2010.33	1071.90
Pioneer 452 D_1	8.32	142.90	80.15	7.99	2601.64	1487.30
Pioneer 452 D_2	7.14	149.80	86.10	8.16	2407.86	1384.04
Pioneer 452 D_3	6.04	140.56	85.12	8.96	2133.45	1291.80
Pioneer 6431 D_1	11.42	141.43	70.61	7.92	2491.29	1243.65
Pioneer 6431 D_2	11.80	151.21	75.21	8.52	2479.62	1233.36
Pioneer 6431 D_3	5.17	131.35	83.50	8.22	2363.72	1455.34
Pioneer 552 D_1	9.44	142.95	82.00	9.40	2147.32	1231.70
Pioneer 552 D_2	9.46	169.75	96.42	9.53	2116.85	1202.37
Pioneer 552 D_3	5.69	156.69	87.58	9.48	2085.57	1165.62
L.S.D 0.05	4.10	8.66	9.15	0.70	337.85	208.07
L.S.D 0.01	5.79	12.24	N.S	N.S	477.63	N.S

DISCUSSION AND CONCLUSIONS

Results on the effect of density, in total, are in agreement with what have already been reported by Curotti and Rosania (1971), Mekki (1984), Nour El-Din et al., (1983 a,b), Swallers and Fick (1973), Struma (1970), on height stem diameter lodging percent, weight/head and seeds/weight head and yield of seeds/plant. The results show that by using a thin density (D3) individual plant characters will improve in addition to less chance of lossing part of the yield by lodging. However, as far as productivity is concerned, results show that yields in relation to density are in this order D1 > D2 > D3. But in other words, seed vield is favored by higher plant density. Also, the interaction of cultivar x density was positive and had a fovorable effect on yield/fad. at least with three cultivars, (Table 3). By the same logic, oil yield is also favored by higher plant density. Therefore, it will be futile to use plant densities less than 35000/fad. Because under higher densities, some complications might pop up such as higher percentages of barren heads, this however, is primarily an inherent tendency that could be avoided by, breeding for varieties of less tendency to lodge under high densities, very specially in programs for breeding hybrid sunflower.

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تقييم بعض أصنـــــاف
عباد الشمس تحت ثلاث كثافـــات نباتيـــة

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أجريت تجربتان بمزرعة كلية الزراعة بمشتهر لتقييم تأثير الكثافات النباتية على نمو ومحصول عباد الشمس فى موسمى زراعة ١٩٩٠ ، ١٩٩١ وكانت الاصناف المزروعة فى الصنف عاليه ، بيونير ٤٥٢ ، بيونير ٥٥٢ ، بيونير ٦٤٣١ وكانت الكثافـــات النباتية هى ٣٥,٠٠٠ ، ٢٣٣٣٣ ، ١٧٥٠٠ نبات / فدان وقد أظهرت الدراسة النتائـــج التاليـــة :-

أولا : بالنسبة للاصـــناف:

١- كانت هناك فروقا معنوية بين الاصناف فى ارتفاع النبات ، عدد الاوراق/نبـــات قطر الرأس والنسبه المئوية للرقـــاد.
٢- تميز الصنفان بيونير ٥٥٢ ، بيونير ٦٤٣١ بنسبه رقـــاد نرتفعه وبنسبه مرتفعه من الرؤوس الخالية من البذور عن مثيلتهـــا .
٣- تميزت الاصناف بيونير ٤٥٢ ، ٥٥٢ ، بيونير ٦٤٣١ بارتفاع وزن الرأس ، ووزن البذور / رأس عن الصنف عاليـــة .
٤- تفوق الصنف عاليه عن الاصناف البيونير الثلاث فى كميه المحصول من الرؤوس للفـــدان وكذلك كمية محصول الفـــدان من البـــذور.
٥- لم تظهر الدراسة فروقا معنوية بين الاصناف فى النسبه المئوية للزيت وتفوق الصنف عاليه فى محصول الفدان من الزيـــت.

ثانيا : بالنسبه للكثافـــات:-

١- كانت النباتات النامية تحت الكثافه (د٣) أقصر طولا وأكثر سمكا عن النباتـــات النامية تحت الكثافتين الاخريين د١ ، د ٢ .
٢- كانت النباتات النامية تحت الكثافة (د٣) أقل ميلاللرقـــاد عن الكثافتين الاخريين.
٣- أعطت النباتات النامية تحت الكثافة (د٣) عددا من الرؤوس الخالية من البذور.
٤- تفوقت النباتات النامية تحت الكثافة (د٣) فى وزن الرأس وكمية البذور بالنسبـــه للرأس .
٥- أعطت الكثافة (د١) أعلى محصول من الرؤوس / فدان ، البذرة / فدان ، الزيت/ فدان.
٦- كان للتفاعل الكثافة x الاصناف أثرا معنويا على صفات نسبة الرؤوس الخاليـــة من البذور ، وزن الرأس ، وزن البذور ، وزن ١٠٠ بذره ، محصول الفدان مـــن الرؤوس ومحصول الفدان من البـــذور .