

EFFECT OF HARVEST TIME ON OIL CONTENT AND YIELD OF SUNFLOWER IN IRAN

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I - SUMMARY

Five varieties of sunflower, which are considered to have the same yield, oil content, and harvesting time (1), were harvested at four different times after seed constitution, and the effect of harvesting time on oil content, ratio of $\frac{\text{grain shelled}}{\text{total weight of grain}}$, weight of 1 000 grains, and number of grains per plot were studied.

This study showed that early harvesting had a significant repercussion on the yield, because there was no significant differences in oil content, weight of 1 000 grains or ratio of $\frac{\text{grain shelled}}{\text{total weight of grain}}$, between the second and the fourth harvest, but the number of grains per plot, in second harvest, is about 20 % more than the fourth harvest.

II - INTRODUCTION

When sunflower is fully matured it's attacked by birds, especially by sparrows. Then there is a shedding and more than 50 % of seeds are lost (2). (Tables n° 7 and 8 show, in spite of good supervision, about 25 % of the number of grains per plot is already decreased between the first and the fourth harvest.)

The selection of concave varieties which have a relative solidarity of seeds did not result (3). We conducted the study to find the best harvest time before the onset of shedding.

This study is an original research project in this area and the literature cited is limited in number.

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III - MATERIALS AND METHODS

Field studies

Field studies were conducted at the College of Agriculture of Univ. of Tehran Farm in Karaj during 1970. The land was under wheat cultivation, prior to the experiment, and had received 30 Tons of manure per Hectar.

The dimension of each plot was $1.5 \times 2 \text{ m}^2$. The distance between the rows was 5 m and between the plants on each row was 4 m. The number of plots was 100.

The 5 sunflower varieties studied were :

Armavirsky, Record, Tchirnanca, Vniimk 8931, and Local.

The design of experiment was split-plot (4 and 7) with 5 replications, and the date of seed sowing was April 7, 1970. According to the date of harvesting the number of irrigation was 5 or 6.

The four harvest times were as follows : July 22, July 29, August 5, and August 12.

One row from each side of each plot and 1 meter from the top edge and bottom edge of each row were eliminated for the "border effect". The rest was harvested and mixed. We selected the samples from this mixture.

Laboratory studies

Laboratory tests were conducted during the interval of time between each harvest and following fall. The main subject of investigation was the oil content of each treatment. This factor was interpreted by raw oil and extracted by the Soxhlet method (5 and 6). The other factors measured in Laboratory were : the percentage of grain shelled/total weight of grain, the weight of 1 000 grains and the number of grains per plot after harvesting.

IV - RESULTS AND DISCUSSION

According to table 1 and its analysis of variance (table 2), we can see a significant difference, at the 1 % level. This difference in oil content is due to the time of harvesting between the first and the other harvest (referring to L.S.D. calculation, table 2b). There were no significant differences between the second, third, and fourth harvest.

According to tables 3, 4 a and 4 b, there was a significant difference in the ratio of grain to shell between the first and the other harvests, at the 1 % level. This difference in shell is due to the time of harvesting between first and other harvests.

According to tables 5, 6 a and 6 b, there was a difference in weight of 1 000 grains between the first and the other harvests (this difference was significant at the 5 % level).

We can state also that there is a significant difference, at the 1 % level, between different number of grains per plot (tables 7, 8 a and 8 b). In the first and second dates of harvesting, the number of grains was much more than the two other harvests.

V - CONCLUSION

Admitting that oil content, weight of 1 000 grains and the ratio of grain shelled to total weight of grain are the same in the second, third, and fourth harvest, but the number of grains in the second harvest is much more than the fourth harvest. It could be concluded that early harvesting is one of the solutions of the shedding problem, this is if machinery harvesting does not cause further problems. In Iran there is no machine problem because labor is much cheaper than machine work.

Other complementary research could be attempted in this area and could be named "effect of harvesting time on protein content of sunflower's oil-cake", and "effect of harvesting time on fatty acids percentage of sunflower's oil".

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Table 1 - Oil percentage of grain shelled

First harvesting date	A	43	C	36	B	48	E	58	D	55	Rep. 1
Second " "		57		59		53		62		57	
Third " "		60		60		64		57		56	
Fourth " "		64		60		63		60		60	
First " "	E	53	A	53	D	51	C	60	B	60	Rep. 2
Second " "		57		41		63		60		58	
Third " "		58		61		61		63		56	
Fourth " "		63		59		58		65		60	
First " "	C	39	B	49	A	55	D	49	E	61	Rep. 3
Second " "		64		61		60		58		63	
Third " "		61		58		59		55		60	
Fourth " "		60		62		64		63		58	
First " "	B	36	D	53	E	56	A	48	C	58	Rep. 4
Second " "		46		58		54		60		60	
Third " "		56		60		57		60		60	
Fourth " "		57		64		62		61		55	
First " "	D	56	E	59	C	58	B	40	A	45	Rep. 5
Second " "		56		62		60		61		55	
Third " "		61		63		63		64		54	
Fourth " "		51		61		59		58		58	

Table 2a - Analysis of variance

S.O.V.	d.f.	SS	M.S.	F
rep.	4	57.54	14.38	
Main Effect A (varieties)	4	186.94	46.23	1.37
E (A)	16	540.96	33.81	
Effect B (time of harv.)	3	1 275.84	425.28	18.50**
A x B	12	324.06	27.005	1.17
E (B)	60	1 378.1	22.96	
Total	99	3 763.64		

Table 2b - Harvest time
groups for oil content

L.S.D. = 2.7

First H.D.	51.16	Group II
Second H.D.	57.80	Group I
Third "	59.48	
Fourth "	60.20	

** Significant at the 1 % level

Table 3 - Percentage of grain shelled/total weight of grain

First harvesting date	A	62	C	45	B	51	E	73	D	70	rep. 1
Second " "		66		72		65		66		65	
Third " "		68		73		68		68		67	
Fourth " "		70		60		66		62		72	
First " "	E	62	A	64	D	65	C	68	B	73	rep. 2
Second " "		68		45		67		77		67	
Third " "		65		70		63		69		69	
Fourth " "		54		69		70		70		69	
First " "	C	33	B	61	A	64	D	61	E	65	rep. 3
Second " "		77		66		66		70		69	
Third " "		72		66		54		65		64	
Fourth " "		69		70		71		72		66	
First " "	B	28	D	65	E	58	A	49	C	73	rep. 4
Second " "		54		72		65		72		76	
Third " "		62		69		65		70		56	
Fourth " "		71		67		66		71		75	
First " "	D	60	E	65	C	70	B	48	A	49	rep. 5
Second " "		70		55		76		68		67	
Third " "		66		56		66		73		65	
Fourth " "		77		69		64		79		77	

Table 4a - Analysis of variance

S.O.V.	d.f.	SS	M.S.	F
rep.	4	8.0	2.0	
A (var.)	4	33.7	8.4	1.5
E (A)	16	84.1	5.3	
B	3	129.7	43.2	6.9**
A x B	12	120.7	10.5	1.6
E (B)	60	376.3	6.2	
Total	99	752.5		

** Significant at the 1 % level

Table 4b - Harvest time groups for % grain shelled/total weight of grain

L.S.D. = 6.66

Harvest Time	Mean	Group
First H.D.	59.28	Group II
Second H.D.	66.64	Group I
Third "	65.96	
Fourth "	69.04	

Table 5 - Weight of 1,000 grains (gram)

Harvesting Date	Rep.	Group	Weight (g)
First harvesting date	rep. 1	A	41
		C	29
		B	50
		E	55
Second " "	rep. 2	D	71
		A	53
		B	46
		C	46
Third " "	rep. 3	D	56
		A	67
		B	60
		C	86
Fourth " "	rep. 4	D	52
		A	45
		B	56
		C	52
First " "	rep. 5	D	51
		A	72
		B	34
		C	58
Second " "	rep. 1	D	56
		A	78
		B	53
		C	97
Third " "	rep. 2	D	48
		A	46
		B	58
		C	46
Fourth " "	rep. 3	D	52
		A	48
		B	51
		C	42
First " "	rep. 4	D	32
		A	29
		B	52
		C	46
Second " "	rep. 5	D	50
		A	64
		B	47
		C	50
Third " "	rep. 1	D	50
		A	52
		B	47
		C	65
Fourth " "	rep. 2	D	53
		A	59
		B	67
		C	52
First " "	rep. 3	D	62
		A	33
		B	50
		C	43
Second " "	rep. 4	D	68
		A	45
		B	65
		C	68
Third " "	rep. 5	D	64
		A	67
		B	83
		C	52
Fourth " "	rep. 1	D	62
		A	57
		B	57
		C	44
First " "	rep. 2	D	25
		A	71
		B	45
		C	25
Second " "	rep. 3	D	37
		A	39
		B	55
		C	58
Third " "	rep. 4	D	46
		A	55
		B	47
		C	59
Fourth " "	rep. 5	D	84
		A	103
		B	54
		C	67

Table 6a - Analysis of variance

S.O.V.	d.f.	SS	M.S.	F.
rep.	4	209.66	52.415	
A (var.)	4	840.56	210.14	1.92
E (A)	16	2 044.99	127.81	
B	3	1 986.03	662.01	3.53*
A x B	12	2 548.72	212.39	1.13
E (B)	60	11 265.75	187.76	
Total	99	18 895.71		

Table 6 b - Harvest time groups for the weight of 1 000 grains.

L.S.D. = 7.75

First H.D.	46.88	Group II
Second H.D.	54.84	Group I
Third "	58.68	
Fourth "	56.52	

* Significant at the 5 % level

Table 7 - Number of grains per plot

First harvesting date	A	1 167	C	1 222	B	971	E	1 120	D	1 165	rep. 1
Second " "		980		1 230		889		1 170		1 375	
Third " "		1 125		1 005		1 070		735		1 325	
Fourth " "		902		1 020		901		775		1 003	
First " "	E	1 220	A	1 021	D	1 142	C	1 160	B	1 097	rep. 2
Second " "		1 171		1 131		1 110		1 055		1 015	
Third " "		930		1 010		1 021		1 165		1 355	
Fourth " "		975		904		980		915		1 010	
First " "	C	1 145	B	1 122	A	1 285	D	1 229	E	1 073	rep. 3
Second " "		1 121		1 165		1 270		1 232		1 020	
Third " "		1 350		835		1 190		1 110		1 035	
Fourth " "		1 020		1 075		1 091		931		900	
First " "	B	1 468	D	1 020	E	1 160	A	1 215	C	1 016	rep. 4
Second " "		1 160		1 165		1 152		1 260		1 014	
Third " "		1 611		1 035		1 007		1 130		842	
Fourth " "		1 085		1 042		1 020		900		943	
First " "	D	1 485	E	1 225	C	1 750	B	1 325	A	1 270	rep. 5
Second " "		1 380		1 175		1 405		1 185		1 240	
Third " "		995		860		1 132		965		1 130	
Fourth " "		751		756		1 015		915		1 075	

Table 8a - Analysis of variance
Comparison of 4 means (6)

S.O.V.	d.f.	SS	M.S.	F
Total	99	3 054 558	30 854	
Treatment	3	891 851	297 283	13.19**
Error	96	2 162 707	22 528	

** Significant at the 1 % level

Table 8b - Harvest time groups for
the number of grains per plot

L.S.D. = 83.202

H.D. 4	956.1	Group III
H.D. 3	1 078.7	Group II
H.D. 2	1 162.7	Group I
H.D. 1	1 202.9	