HELIA, **13**, Nr. 13, p.p. 29-34 (1990)

EFFECT OF MATURITY STAGES AND DESICCANT APPLICATION ON YIELD AND OIL QUALITY OF SUNFLOWER (*Helianthus annuus* L.)

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SUMMARY

In this paper, the authors describe an investigation undertaken in 1988 and 1989 to study the effectiveness of locally marketed desiccants, 'Bi-pyridinium' and 'Fomesafen', in allowing an early harvest of sunflowers without loss in seed yield, oil content and quality. The experiment was carried out after the method of randomized complete blocks in four replications.

The two desiccants, in two doses, were applied at 5-day intervals 18, 23, 28, 33 and 38 days after the flower completion (DFC). The harvesting was conducted seven days later, i.e., at 25, 30, 35, 40 and 45 DFC. The results of the investigation are presented in four tables and eight graphs.

INTRODUCTION

In irrigated regions, attempst are being made to realize high field efficiency for making higher income per unit area per annum. In order to achieve it, growers are frequently dragged into a situation where harvesting of the existing crop and planting of the next crop overlap with each other. Consequently, it results in yield losses of the preceding crop due to early harvesting, and following crop due to delayed planting. Manipulation of appropriate crop production technology and execution of high management skills are therefore required to handle such situations. Planting of short duration varieties, use of desiccants and mechanized harvesting and planting strategies are imperative for receiving high returns from the crops involved in the intensive cultivation systems.

Use of desiccants is an established practice in some crops where mechanical harvesting and uniform ripenning is a prime desire. In situation as stated above, it has become rather more important to harvest the crop at the earliest possible date, but without taxing the yield, to allow a timely planting of following crop. Such decisions would be based on the knowledge of crop maturity time coupled with the use of appropriate desiccants. In USA, Dimethipin (1, 2, 3-dihydro-5, 6-dimethyl-1, 4-dithin-1, 1, 4, 4-tetraoxide) was used as desiccant in sunflowers in different doses, and found that maturity was enhanced (1, 2) without loss of yield, oil content and quality. Similar results were reported from France (3). Diquat (6, 7- dihydrodipyridol [1,2-a:2,1-c] pyrazinediium ion) has also been used successfully as harvest aid in sunflowers (4). It has been reported that physiological maturity in sunflowers is attained when seeds reach a

moisture content between 36-40% (5, 6), and it took 35 days after anthesis (6) or 25 days after flower completion (7).

Table 1. Desiccation treatments, application rates, commercial, common and chemical names of the desiccants followed by their formulated activity.

Treat.	Rate used	Commercial name	Common name	Chemical name	Formulation (kg ai/ha)
D1	0,50	Gramoxon	Paraquiat	1 : 1 -Dimethyl-4,4 - Bipyridinium (caton) dichloride	20% AS
D2	0,25*				
D3	1,00	Flex	Formesafen	5-[2-chloro-4-(trifluoromethyl) Phenoxy] -N-(methyl-sulfonyl) -2-nitrobenzamide	21% EC
D4	0,50*				
		Adjuvant	Agral-90	[900 g/1 alkyl phemol ethylene oxide condensate]	87% W/W
Control				no desiccant was applied	2% V/V

* Each lower rate of the two herbicides used as desiccant was mixed with the non-ionic surfactant "Agral-90" to enhance the efficacy of the product.

Source: Thomson, W. T. 1984, Agricultutal Chemicals - Book II. Thompson Publications, Fresno, Ca 93791.
Agral-90, Technical Bulletin. ICI, Plant Protection Unit, Fernhurst Tasemere Surrey, England.

In Pakistan, we do not have many registred chemicals (Table 1.) and therefore, not available on the market, except the "Bi-pyridinium" (Paraquat) which is mainly used as a non-selective broadleaf herbicide in potatoes. Fomesafen[1] sensitive compound which has contact-type mode of action which is a property unique to defoliants. It was therefore decided to, initially, include these two chemicals in our present study. Cost effeciency of the desiccants was also considered by reducing the rate of the chemical to half strength, and simultaneously adding a low cost non-ionic surfactant "Agral-90" to increase their efficacy. Objectives of the study were to find out the earliest stage of maturity where sunflower could be harvested without considerable loss of yield, and to test the desiccants available in the local market for their effect on maturity, yield and oil content and quality.

MATERIAL AND METHODS

This research project was conducted at the National Agricultural Research Centre (NARC), Islamabad (33° 40 N 73° 08 E), Pakistan. The trials were planted on February 7, and February 10, during 1988 and 1989, respectively. Daily maximum, minimum temperatures and precipitation from May 1 to June 20, during 1988-89 (as recorded by the meteorology department of NARC) along with the date of flower initiation (DFI) and the date of flower completion (DFC) are given in Figure 1. The trials were maintained according to the local production recommendations. Fertilizer was broadcasted at the rate of 120 kg N + 60 kg P_2O_5 per hectare, all applied simultaneously at the time of seedbed preparation. The plots were irrigated twice throughout the growth period, at head initiation stage and flower completion stage.

1 Fomesafen is an ICI product submitted to the PltPtcon Department registration as post-emergence herbicide. It is likely to be marketed some time in 1990.

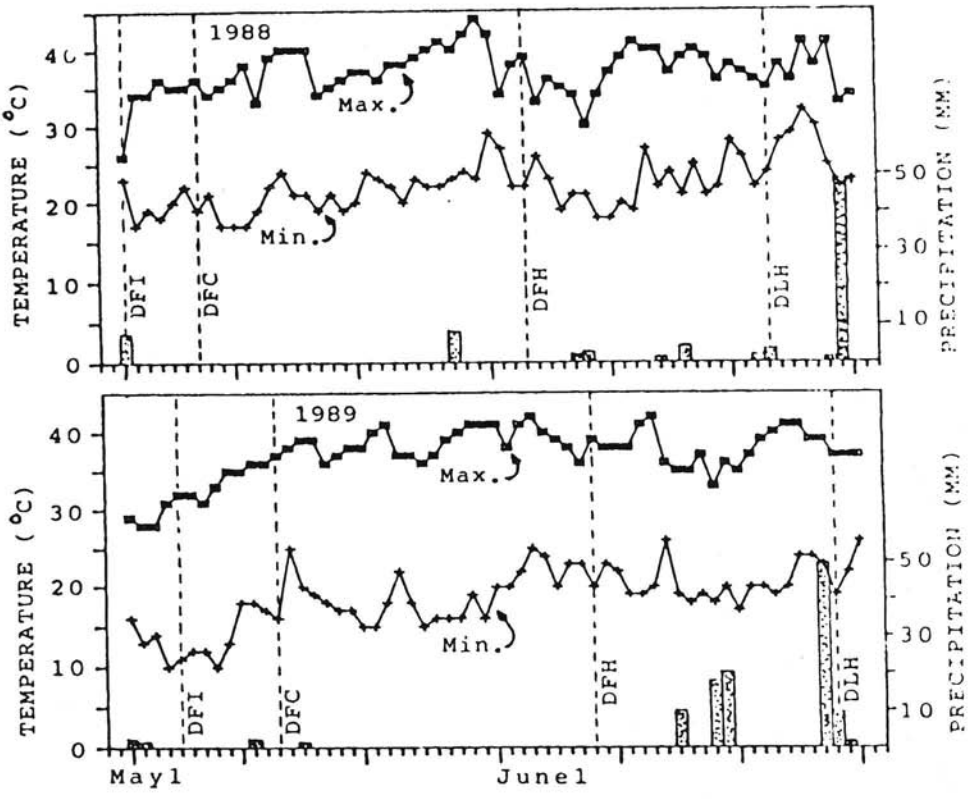

Fig. 1. Daily minimum and maximum temperature and precipitation from May 1 to June 30, showing date of flower initiation (DFI), date of flower completion (DFC), date of first harvest (DFH) and date of last harvest (DLH) during 1988 and 1989.

Five dates of harvest treatment were superimposed with two desiccant applications, each with two rates and one control treatment (without desiccant application), in a split plot experimental design. Date of harvest treatments were arranged as main plots and desiccant application in subplots in a randomized complete block, replicated four times.

Table 2. Dates of desiccant application and harvesting, growing degree days (GDD) from flowering initiation (FI) to date of last harvest (DLH) and precipation received from date of planting (DP) to last harvest

Year	Date of desic. applic.	Date of harvest	GDD * FI TO DLH	Precipitation PD to LDH (mm)
1988	May 27	June 3	1384	236
	June 1	June 8		
	June 6	June 13		
	June 11	June 18		
	June 16	June 23		
1989	June 1	June 8	1363	187
	June 6	June 13		
	June 11	June 18		
	June 16	June 23		
	June 27	June 28		

* [(Max. temp. - Min. temp.)/2] - 3,1°C

Desiccant treatments (Table 2) were applied at 5-day intervals 18, 23, 28, 33 and 38 days after the flower completion (DFC). Calibrated doses of the desiccants were thoroughly mixed into a known volume of water used as diluent. The treatment solutions of the desiccants were sprayed on top of the sunflower canopy with the help of an aluminium ladder. Solid-cone type brass nozzle was mounted on a knap-sack type manual sprayer to achieve complete wetting of the foliage. The harvesting took place seven days after each desiccant application, at 25, 30, 35, 40 and 45 DFC (Table 3). The DFC was standardized when about 90% of the floral buds were open to start anthesis.

Table 3. Average effect of maturity stages on yield, seed test weight moisture content and oil quality of sunflower.

Days after flower completion	Yeld (kg/ha)	100 Seed weight (g)	Seed moist. con. (%)	Oil content (%)	Palmitic acid (%)	Oleic acid (%)	Linoleic acid (%)
25	2305	6.22	47.1	40.2	5.8	51.5	39.5
30	2645	7.12	35.3	43.1	5.8	50.3	40.6
35	2838	7.67	24.1	43.7	5.6	48.9	43.4
40	2818	7.90	16.2	44.2	6.1	48.7	43.2
45	2840	7.91	10.7	44.8	5.7	48.0	43.6
LSD (0.05)	81	0.21	7.10	0.6	0.3	0.9	0.9

The size of subplots was 3x5 m (4 rows each 5 meters long and 0,75 m apart). Sunflower hibrid NK-212 was planted, and the plants were spaced 25-30 cm apart within the rows. Two central rows were harvested to assess the seed yield. The plots were harvested and threshed manualy and seeds were sun-dried for 12 days before the weights were recorded for yield measurements on per plot basis. The seed yields were converted and reported in kg/ha and adjusted at 8% moisture content of the samples per plot from each of the four replications(Table 4., Figure 2.), and moisture content of the seed (at the time of harvest) was determined by following method: (fresh weight of seed samply drawn from each plot at harvest) - (dry seed weight after oven drying of sample at 70°C for 120 hours)/(fresh weight of seed sample at harvest).

Table 4. Effect of desiccant application on yield, seed test weight and moisture content of sunflower seeds.

Desiccant treatment	Yeld			100 seed wt.			Seed moisture		
	1988	1989	Avg	1988	1989	Avg	1988	1989	Avg
	------(kg/ha)------			-------(g)-------			-------(%)-------		
D1 Paraquat	2270	3019	2645	7.67	6.64	7.16	30.6	22.8	26.7
D2 Paraquat	2386	3185	2785	7.65	6.91	7.28	31.7	22.9	27.3
D3 Fomesafen	2334	3125	2729	8.07	7.03	7.55	29.7	22.6	26.2
D4 Fomesafen	2226	2997	2611	7.75	7.13	7.44	30.5	22.5	26.5
Control	2283	3074	2678	7.81	6.99	7.40	31.0	22.4	26.7
LSD (0.05)	66	N.S.	81	0.25	N.S.	0.21	0.8	N.S.	N.S.

The oil contents (Table 5., Figure 3.) were measured from two seed samples per plot from each of the 4 replications by a nuclear magnetic resonance procedure (Granland and Zimmerman, 1975). A Newport NMR, model Oxford 4000 NMR analyser, was used and oil contents were reported at zero percent moisture content. The fatty acid

composition was measured by Shimadzo gas liquid chromotograph (GLC), model GC-9A, A 2.1 m x 3.2 mm mesh was used for the analyses. The column oven was operated at 230°C. Methylating solution of 4 g metallic sodium prepared in 500 ml methanol was used for preparing methyl esters of oil.

Table 5. Effect of desiccant application on oil content and quality of sunflower oil during 1988-1989.

Desiccant treatment	Oil content			Palmitic acid			Oleic acid			Linoleic acid		
	1988	1989	Avg.	1988	1989	Avg.	1988	1989	Avg.	1988	1989	Avg.
						(%)						
D1 Paraquat	38.5	45.4	41.9	5.3	6.7	6.0	50.7	43.8	47.2	41.8	46.2	44.0
D2 Paraquat	39.6	46.7	43.2	5.2	6.6	5.9	51.0	44.3	47.6	41.4	46.3	43.9
D3 Fomesafen	40.3	47.5	43.9	4.9	6.2	5.6	52.9	48.5	50.7	39.4	42.5	41.1
D4 Fomesafen	39.4	47.4	43.4	5.1	6.4	5.7	53.3	49.7	51.5	39.1	41.7	40.4
Control	39.4	47.6	43.5	5.2	6.5	5.9	52.0	48.8	50.4	40.0	41.8	40.9
LSD (0.05)	0.7	0.9	0.6	0.2	N.S.	0.3	0.8	1.5	0.9	0.7	1.5	0.9

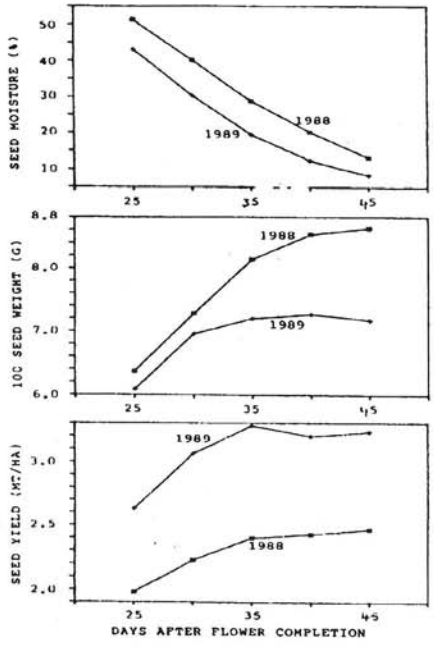

Fig. 2. Effect of stage of maturity on seed yield, 100-seed weight and seed moisture content of sunflower during 1988 and 1989.

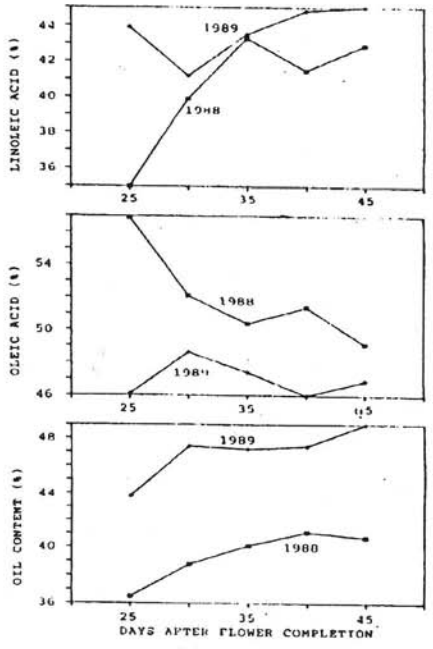

Fig. 3. Effect of stage of maturity on oil content, and fatty acid composition (oleic and linoleic) of sunflower during 1988 and 1989.

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EFFETS DE LA DATE DE MATURATION DE L'APPLICATION DE DESSICANTS SUR LE RENDEMENT ET LA QUALITE DE L'HUILE SHEZ LE TOURNESOL (*Helianthus annuus L.*)

Masood, A. R., Chaudhry, A. O., Khan, A. K. & Sjafiullah

Dans cette publication, les auteurs décrivent une étude conduite en 1988 et 1989, concernant les effets de deux récoltes précoces sans pertes de rendement en grain et en huile et sans alteration de la qualité. Les experimentations ont été menées d'aprés la méthode des blocs complets randomisés, à quatre répititions.

Les deux dessicants ont été appliqués à deux concentrations et à cinq jours d'intervalle: 18, 23, 28, 33 et 38 jours aprés la pleine floraison. Les résultats de ces recherches sont présentés sous formes de tableaux (4) et de graphiques (8).

EFECTO DE LOS ESTADOS DE MADURACION Y APLICACION DE DESECANTES SOBRE EL RENDIMIENTO Y CALIDAD DE ACEITE DE GIRASOL (*Helianthus annuus L.*)

Masood A. Rana, Chaudhry A. Ozair, Ayub Khan y Shafiullah.

En esta publicación, los autores describen una investgación llevada a cabo en 1988 y 1989, para estudiar la efectividad de desecantes comercializados localmente "Bi - pyridinium y Fomesafen" en facilitar una cosecha temprana de girasol sin pérdidas de rendimento, contenido y calidad de aceite. El exsperimento se llevó a cabo utilizando bloques al azar con cuatro repeticiones.

Los dos desecantes en dos dosis, fueron aplicados en intervalos de 5 días, 18, 23, 28, 33, y 38 después de la finalizacion de la floracion.La recolección se llevó a cabo siete días mas tarde, esto es,al cabo de 25, 30, 35, 40 y 45 días después de la floracion. Los resultados de la investigación se presentan en cuatro tablas y ocho gráficos.