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RESEARCH ON SUNFLOWER PRODUCTION AND BREEDING UNDER TROPICAL CONDITIONS

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This study was conducted to determine the performance of different promising varieties of sunflower from other countries under the distinct dry and wet seasons of the tropics in conjunction with breeding for varieties adapted to such conditions.

Results revealed that irrespective of varieties significant difference exists betwenn the crops grown under these two conditions. Days to flowering, plant heifht, maturity, seed yield, oil content, were markedly significant in the wet than in the dry season crop.

Data further showed that the agronomic performance of the varieties tested are relatively comparable with that from the countries where they originated. Hence, sunflower production in the Philippines is feasible limited at present only by information on the more specific cultural management methods.

Several desirable phenotypes were isolated which will be used for breeding pruposes. Among the agronomic characters considered in the selection were : earliness, plant height, diameter and shape of head, non-photoperiod response, seed yield, yield and quality of oil and resistance to major pests and diseases.

The Philippines is located geographically 14°30' latitude and 120°4' longitude. It consists of about 7 100 islands but these are grouped politically into three namely : Luzon, Visayas and Mindanao. Luzon and Mindanao are single islands, while Visayas consists of several islands politically grouped together.

Certain areas of the country seem to be adaptable to sunflower as a commercial crop. The climatic conditions indicate the presence of adequate rainfall during months of the vegetative and reproductive phases followed by a well defined dry season which is a prerequisite to the harvesting and processing of seeds.

The amount of yearly rainfall in the Philippines tends to diminish from East to West averaging 99.61 inches starting with January to May as distinctly the dry season and June to December as the wet season. Likewise, the average number of rainy days is 176 with the same pattern of monthly distribution as that previously stated. The mean relative humidity is 82 percent which is more or less constant throughout the year. Temperature averages 27°C.

To be more specific the Central Luzon area is characterized by a very pronounced dry, hot season followed by a wet, humid season for the months of March through May and June to October, respectively. November and December follow the saying "changeable as the weather" although these months are generally cool and dry with relatively lower humidity.

This study was conducted in the Central Luzon State University located 150 km from Manila in the heartland of the Central Plains of Luzon, PHILIPPINES. Central Luzon is the rice bowl of the country during the wet season and by the dry season much of the land is put to vegetables, onion and garlic production. These crops do not bring much income to the farmers being relatively far from main marketing centers. Hence, there is a need to look for other crops which are not as perishable yet would command good returns.

Sunflower is a new crop in the Philippines which has initially caught the interest and enthusiasm of the local oil-processors and endorsed to the researchers in our institution. A 5-year research program on sunflower was evolved and foremost is the study on the performance of different varieties under the distinct dry and wet seasons in conjunction with the isolation of phenotypes suitable under such conditions.

MATERIALS AND METHODS

The varieties studied were : Peredovik, HO-1, Krasnodarets and Armaveric. These were certified seeds obtained from the Agway Seed Corporation, U.S.A.

Two planting seasons were covered : Season A - February through April, and Season B - June through August. The former is relatively hot and dry, the latter wet and humid.

The seeding rate (hand-sown) was about 8 kg per hectare at a distance of 70 x 30 cm with an average of two plants per hill. This gave an approximate plant density of 50 000. Fertilizer rate was 200 kg N/hectare from Urea and applied singly a week after germination.

All other cultural requirements including control of insect pests and diseases were applied as the need arose.

Data were taken from 100 randomly selected plants from 3 replications for each variety.

RESULTS AND DISCUSSION

Table 1 presents the date on the agronomic performance of the varieties interacting with seasons.

In general, each variety performs differently within seasons which is a reflection of its inherent genetic characteristic. Hence, discussion shall revolve only on the interaction of the varieties between seasons.

DAYS TO MATURITY

Analysis of data showed no significant difference within varieties between seasons, although an average of 5 days was observed.

PLANT HEIGHT

This character was greatly affected by season in that those grown in Season A were significantly shorter than those in Season B. It would seem to show that such a difference can be attributable to the availability of more moisture during Season B than on light intensity and duration per se.

Table 1 - Mean values of the agronomic characters of four varieties of sunflower planted during the dry and wet seasons (1970-71) at Central Luzon State University, Munoz, Nueva Ecija (Philippines)

Variety	Days to maturity	Plant height at maturity	Diameter of head	Percent seed set	Wt of 100 seeds (GMS)	Seed size (cm)	Computed yield/ha (KGM.)	Moisture content (%)	Iodine value	Oil content	
										actual	dry basis
January-April 1971 (Season A)											
Peredovik	96	125.21	14.58	35.94	7.60	1.02	879.12	6.10	101.00	30.14	32.10
HO-1	115	150.80	16.00	32.30	7.50	1.05	316.87	7.08	101.50	32.57	35.01
Armaveric	80	115.06	18.06	40.43	8.30	1.09	1 920.45	6.11	92.76	37.33	39.76
Krasnodarets	83	114.83	14.03	39.48	7.91	1.07	914.20	5.33	90.81	40.63	42.92
Mean	93.50	126.47	15.66	37.03	7.82	1.06	1 007.66	6.15	96.51	35.16	37.45
June to August 1971 (Season B)											
Peredovik	105	201.32	26.35	69.49	8.32	1.38	1 137.12	7.35	96.93	38.52	41.47
HO-1	118	227.45	29.32	73.21	8.47	1.20	1 560.71	6.87	98.65	36.55	39.25
Armaveric	84	176.32	18.43	83.32	9.40	1.76	2 613.23	7.09	73.5	35.57	38.19
Krasnodarets	86	177.41	17.47	81.10	9.30	1.63	1 821.12	5.96	87.5	41.00	38.52
Mean	98.22	195.62	22.89	76.78	8.87	1.49	1 783.04	6.82	89.14	37.91	39.35

DIAMETER OF HEAD

The dry season crop produced significantly smaller heads compared with the wet season crop. It is apparent that a positive correlation existed between diameter of head and plant height.

PERCENT SEED SET AND SEED YIELD

Seed set was markedly affected by season averaging 50 % increase in Season B than in Season A. It should be borne in mind that the area planted to sunflowers were originally ricelands which were harvested in December. Hence, a great portion of the land lie in fallow and no other crops except sunflowers were grown. The climatic condition was hot and dry and under such, insect pollinators specially bees were at its minimal level. This is one of contributory factors for the low seed set in Season A.

Concomittant with this is the hot, dry air which most probably caused the drying of the pollen grains, thus lowering their fertilizing capacity.

As a result of this observation, we are now growing bees as an adjunct to sunflower seed production which we hope will be an added enterprise for the farmers.

Seed yield is the totality of percent seed set, seed size and seed weight.

These three yield components were markedly lowered in Season A than in Season B. Seed size and weight were affected not by the lack of insect pollinators, but by light intensity and duration. During the active photosynthetic stage (February), day light hours and intensity were relatively shorter and less intense than in the month of July. Hence, seeds formed in February were lighter and smaller than those in July.

OIL QUALITY AND YIELD

It is interesting to point out that iodine value was significantly higher in Season A than in Season B. Although this is lower compared to those grown in temperate countries, yet it shows clearly that the time of planting can invariably affect the iodine value. As was found by other workers, sunflower oil produced from plants during relatively cool months contains more unsaturated fats than those grow during hot months. Again, the active phase of kernel formation was during the cool month of February for Season A, thus contributing to the high iodine value.

However, the advantage gained in terms of the iodine value seems to have been offset by the oil content. Season A crop yielded lesser oil both on the actual and dry basis. The average difference ranges from 2-3 percent depending on the variety.

It is well therefore to give this due consideration in terms of varietal response as some varieties do not appear to be affected to a great extent by season.

INCIDENCE OF PESTS AND DISEASES

The most common though not yet very destructive disease observed was Rhizoctonia wilt. Its occurrence was higher in Season B than Season A due to the frequent rains and sometimes water logging of the area.

Insect pests were minimal ; most common were the cutworms and head worms which were easily controlled by insecticides. Incidence of stemborers was also observed only during Season B, but none at all in Season A.

Weeds were not a nuisance since the crop easily shaded and outgrew them.

SELECTION OF PHENOTYPES AS POSSIBLE GENETIC STOCKS FOR BREEDING

It is interesting to point out that the varieties under study were still segregating and this gave an excellent opportunity for us to select for some phenotypes which we felt will be adapted to our conditions.

Among the agronomic characters sought for were earliness, medium height (120-150 cm), diameter and shape of head, non-photoperiod response, seed yield per se and resistance to insect pests and diseases.

In conjunction with the breeding work, intensive studies are now in progress on its floral biology under our conditions. Moreover, studies on percent crossability, techniques in artificial pollination and search for genetic markers especially on seeds and seedlings and mode of inheritance of certain agronomic characters are given emphasis.

I would like to take this opportunity to enjoin the plant breeders present here to exchange experiences along the above-mentioned topics in order for us to be able to learn these basic information.

Likewise, I do wish that we be able to set the baseline in order to compare the agronomic performance under different conditions of growing. This would mean setting the "standard" plant population density, the data to be taken, the method of oil analysis, etc...

In conclusion, I wish to acknowledge my sincere gratitude to the Philippine National Science Development Board, the Ford Foundation and the Philippine Refining Co. for financing my attendance to this Conference and to the host government for the cordialities it has afforded me.