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INTRODUCTION AND DEVELOPMENT OF *BRASSICA* SPECIES WITH HIGHER OIL CONTENT

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A hybrid of *B. napus* and *B. oleracea* which is claimed to contain 48-50 % oil content was successfully cultivated on the PCSIR Campus, Lahore. It is observed that this crop matured quicker (153 days) had maximum seed yield and higher oil content and it was pest free when sown in the last week of October. Various cultivation parameters and results have also been discussed.

Key words: *Brassica*, Development, Oil content.

INTRODUCTION

The chronic shortage of edible oils has persisted in the country for the last few years and the edible oil continues to be a major food item of the national imports.

The rapid increase in the consumption of ghee (11 % annually), rising burden of subsidy and almost stagnation in the domestic production of edible oil has led to an enhanced import bill year after year. Which has increased from Rs. 3.450m in 1982 to Rs. 8.800m in 1984-85 (11 % of total import). At the same time the subsidy paid by Federal Budget has gone up from Rs. 820 million in 1982 to 2,245 million in 1984-85 (2.7 % revenue budget) Khan [4]. It is estimated that the country would import this commodity worth Rs. 15 billion over the next decade representing the largest single food item and only next after petroleum.

After cotton, rape and mustard is the main oil seed crop. Contributing 35 % approx to the domestic requirement. Although an increase in yield/hectare upto 5.06 % is being obtained during last ten years but still the average yield is very low (602 kg/ha) as compared to other rape and mustard growing countries (1037 kg/ha). Furthermore its seed contain lesser oil content (Av. 34-35%) than the European varieties (45-47%) Amin, [2]. In brief the over all performance of the existing crops has been discouraging.

With the objective to introduce the Brassica species with higher oil content, a hybrid of *B. napus* and *B. oleracea* which is claimed to have 48-50% oil content (Qazi, [5] has been successfully cultivated on the PCSIR Campus, Lahore. This hybrid can be distinguished from other oil seed producing *Brassica* species by its white flowers.

In the present paper various parameters used for its cultivation and for the determination of its oil content have been described.

EXPERIMENTAL

(A) *Viability test.* Seeds viability was tested by following methods:

(i) Seeds were found 90-95 % viable when germinated on moist blotting papers, and in earthen pots containing ordinary clayey soil. The germination completed within 48-72 hours in October. (ii) The seeds viability was also tested by using 2,3-5 triphenyl tetrazolium chloride following Wharton's [3] method. The percentage of viable seeds was found to be between 95-98 %.

The viability of seeds can be tested round the year by second method.

(B) *Preparation of the field.* The experimental field covering an area of 10 marlas (250 sq.yds) was extensively ploughed twice, and levelled so as the nutrients and water were uniformly distributed. Followed by the picking up of the weeds and breaking up of large lumps of clayey soil. No fertilizer was supplied at this sowing but for previously sown *Brassica* crop the soil was prepared by mixing cow dung and leaf manure in the proportion of 1:1 to a depth of about 30-35 cm.

(C) *Seed sowing.* The first replicate was sown on raised ridges in lines by hand and the seeds were put 5-10 cm. deep in the soil whereas the 2nd and 3rd replicates were sown by broadcasting.

(D) *Thinning and eradication of weeds.* In order to obtain a good plant growth and high seed yield the thinning and weed removal is essential. Thinning of the plants was carried out at 4 leaf stage and the plants were spaced apart from 9-12" (25-30 cm) in first replicate and 20 to 25 cm in 2nd and 3rd replicates. At the sametime weeds were also removed. Later on two more hoeings were done during the growth period of the crop in second and third replicates but more hoeings were required for the first trial as weeds were abundant throughout its growth as explained in Table 2.

(E) *Irrigation*. In addition to rain (45 mm) the first replicate was irrigated once in early stage so as to help the initial growth of the plant; second after seed germination; third at the flowering and 4th at pod formation stage. Whereas second and third replicates were irrigated thrice only i.e. at the time of sowing, flowering and at pod formation stages.

(F) *Insect pests and diseases*. Rape and mustard crop is attacked by many insects particularly by aphids (*Brevicoryne brassicae*) at both early and late stages. The first replicate of the present crop was attacked by aphids blight mildew and *Alternaria*, at the late stage but caused no serious damage.

(G) *Harvesting*. Harvesting time of rape and mustard crop is very critical and needs special attention as delayed harvesting may cause losses in yield due to shattering. The crop was harvested as soon as the pods started to turn yellow.

(H) *Estimation of oil content*. The oil content in seed of the parent (F6) and all the three replicates (F7) was estimated by the following method.

The weighed amount of grounded seed sample packed in the thimble was placed in the Soxhlet extractor. Hexane was (BP 60-68^o) used as solvent for extraction. After an extensive extraction in Soxhlet apparatus for 8 hours the solvent was either evaporated or distilled to get pure oil. The percentage of the oil was calculated basing on the weight of the pure oil.

RESULTS AND DISCUSSION

The hybrid seeds (F6) of *B. napus* and *B. oleracea* ($2n=38$) were sown in three replicates at different timings of the year at PCSIR campus Lahore, to assess their optimum cultivation conditions and for obtaining a comparatively short duration *Brassica* crop with maximum seed yield and seed oil.

The sowing timings of the three replicates were planned in such an order, so as to coincide with the sowing timings of the established *Brassica* species. For example the first replicate was sown in second week of September and second and third replicates were sown in first and last weeks of October, 1986, which are the usual sowing timings of *B. campestris* (poorbi raya and toria) and *B. juncea* (raya) respectively in Lahore Division, Eco-Meteorological and other datas are shown in Table 1.

Initially plants of first replicate grew faster i.e. more vegetative growth resulting in taller plants (photograph C, plants in the background) than observed in the other two replicates at this stage. Due to the shaded location of the

first replicate plants were exposed to variable photoperiods as a result plant were not uniform in height and the ontogenic differentiation in the individual plant and the maturity of pods varied in time. Whereas the plants of second and third replicates were more or less uniform in height and in their ontogenic differentiation and in pod's maturity (Photos A-C). Details of observations on cultivation are given in Table 2.

Various stages in the development of *Brassica* species (A.H).



A. Flowering stage (General view).



B. Early fruiting stage.

The harvesting of first replicate began in third week of March 87 (Table 1) i.e. this replicate took almost 194 days to mature though the podding started in the second week of January, the pods did not mature till third week of March. The harvesting of second and third replicates com-



C. Late fruiting stage.

menced in third and last week of March (Table 1) i.e. both crop matured in about 168 and 153 days respectively. The growth period of first replicate can be compared to that of *B. napus* (Tower, Oro) whereas that of second and third replicates to *B. campestris* (B.S.A.). The above observations indicate that the Eco-Meteorological conditions (i.e. humidity, temperature and photo-period (Table 1) prevailing in the month of March at Lahore are suitable for ripening *Brassica* fruits.

Due to the variability in the maturity of pods and shattering of pods in first replicate the seed yield was low (i.e. 30.00 kg/hectare) in comparison to the second and third replicates of the same crop. The second and third replicates yielded 182.00 kg and 276.00 kg/hectares respectively which in turn is quite below the standard seed yield of established *Brassica* species (602 kg/ha). The causes of low seed yield may be due to (i) the abundance of weeds and previously sown *Brassica* species, (ii) less reproductive growth (iii) excessive moisture in first replicate and also due to lack of fertilizer and lot of shattering in all the three replicates.

Table 1. Eco-meteorological data of *Brassica* sp.(Hybrid)
(Average of temperature, humidity, photoperiod and rainfall from 9.9. 1986 to 29.3.1987)

Sr. Stages No.	Date and time	Temperature		Humidity		Photoperiod	Average rainfall (mm)
		Min °C	Max. °C	Min. %	Max. %		
Replicate No. 1							
1. Sowing	9.9.1986 at 10.00 A.M.	24.1	35.9	50	72	8.9	80.0
2. Germination	12.9.1986	"	"	"	"	"	80.0
3. Flowering	3.12.86 (commenced)	5.7	22.0	54	90	7.9	10.7
4. Fruiting	10.1.86 "	5.4	20.5	53	"	"	21.0
5. Harvesting	March, 87 22.3.87	13.1	27.8	35	66	8.5	24.4
Replicate No. 2							
1. Sowing	7.10.1986 at 10.00 A.M.	17.2	41.0	42	68	9.3	9.9
2. Germination	10.10.1986	"	"	"	"	"	"
3. Flowering	31.12.86 (commenced)	5.7	21.9	54	90	7.9	10.7
4. Fruiting	30.1.86 "	5.4	20.5	53	90	"	21.0
5. Harvesting	March, 87 25.3.87 "	13.1	27.8	66	35	8.5	24.4
Replicate No. 3							
1. Sowing	27.10.1986	17.3	33.9	42	63	9.3	9.9
2. Germination	30.10.1986	"	"	"	"	"	"
3. Flowering	2.2.87 (commenced)	8.1	22.4	43	82	7.6	23.1
4. Fruiting	20.2.87 "	"	"	39	77	"	23.5
5. Harvesting	29.3.87 "	13.1	27.8	35	66	8.5	24.4

Foot note:- Soil used : clayey.

Table 2. Observations on cultivation trials of *Brassica*. sp. at Lahore.

Sr. No.	Sowing time	Germination	Spacing	Flowering period	Harvesting period	Oil content	Remarks
Replicate No. 1							
1.	9.9.1986 at 10.00 A.M.	90 % app.	25-30 cm	Early December – January	March – April 1987	34.6 %	Due to the partial shading the plants were exposed to different photoperiods as a result of the crop was not uniform in growth. The seed yield and their oil content were adversely influenced by the abundance of weeds and shattering of pods.
Replicate No. 2							
2.	7.10.86	90 %	20-25 cm	Mid.	March –	37.8 %	The growth rate was normal. A considerable amount of flowers and seeds were wasted due to the plants lodging and pods shattering as a result of unusual wind storm. In spite of the above fact seeds yield and their oil content was better than the replicate-I.
Replicate No. 3							
3.	27.10.1987 at 10.30 A.M.	More than 90 %	20-25 cm	February	March– Apr. 1987	39.8 %	The growth rate was slow initially. But after few weeks it accelerated and compensated. Loss of seeds by winds also occurred. But in spite of it the yield was maximum among the 3 replicates and the seeds contained more oil content.

The oil content in seeds of the parent (F6) and three replicate (F7) sown in different months of the year 1986 (Tables 1 and 2) was estimated. The results indicate that the oil content in the seeds of hybrid (F6) was 40.6 % whereas seeds of first, second and third replicates of F7 contained 33.9, 37.3 % and 39.3 oil content respectively.

Although there is always a gap between potential and actual oil production of any oil seed crop but in the present cultivation experiment there is not much difference in the seeds oil content of parents and those of third replicate.

In the light of observations it may be assumed that the optimum sowing time at Lahore Division for this hybrid (F6) of *B. napus* and *B. oleracea* is the last week of October as this timings provides the crop optimum Eco-Meteorological environmental conditions resulting in the maximum seed yield and higher oil content (3rd replicate, Tables 1 and 2).

Furthermore, usual sowing time for *Brassica* crops is between August and September whereas this hybrid can be sown as late as first week of November so the farmers gain

about two months for their Kharif crop. The maturing period of the crop is approximately 150 days which is comparable to that of some varieties of *B. campestris*.

It is hoped that by the adaptation of *Brassica* species with higher oil content and by using improved cultivation practices the domestic production of edible oils can be increased considerably.

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