

## STUDIES ON THE PHYSIO-CHEMICAL CHARACTERISTICS OF A NEW GENOTYPE OF AUTUMN (ZAID KHARIF RAYA)

Abdul Hamid Khan, Abdul Haque Sheikh, Altaf Hussain Shah and Shafiq Ahmad Khan\*

*Oilseeds Research Institute, Faisalabad*

(Received April 9, 1987; revised December 15, 1987)

Studies were conducted to determine the physio-chemical characteristics of RD-80, a new *Brassica juncea* cultivar. RD-80 flowered and matured 15-20 days earlier than both parents, viz, Poorbi raya and Raya N.S. The variety was shorter in height (131 cm) than Poorbi Raya (141 cm) and Raya N.S (143 cm). Three-year results showed that the number of pods/plant (832), mean 1000 seed weight (2.85 g) and seed yield (2251.75 kg/ha) were also higher than those of the parents i.e. Poorbi raya (2090.24 kg/ha) and Raya N.S. (1893.05). The oil yield, physio-chemical composition and fatty acid composition is comparable with both parents.

*Key words:* *Brassica juncea*, yield (kg/ha), RD-80, raya N.S. Poorbi raya, fatty acid composition.

### INTRODUCTION

The vegetable oil requirements of Pakistan have been increasing steadily during the last few decades. Factors such as low seed yield of oilseed crops, increase in population and improvement in the living standards of the people have been attributed as some of the reasons for this increase [1,6].

To meet this deficit arising due to increasing requirements and stagnant domestic production, a number of steps have been taken in this regard. These steps include the increase of acreage under new/old oilseed crops, adoption of better management practices and introduction of better oil/seed yielding varieties [4].

Rapeseed and mustard are important oilseed crops of the country and grown extensively. Indian mustard (raya) enjoys some advantages over Toria and brown Sarson for maintenance of purity and seed production [3].

However, the existing zaid kharif raya cultivar (Poorbi raya) of the Punjab province matures late with the result that wheat cannot be sown after it. This has resulted in the stagnation of the acreage under rapeseed and mustard [3]. The development of early maturing varieties of raya, after which wheat can be sown is, therefore, a necessity. In order to meet this demand, the Oilseeds Research Institute, Faisalabad, concentrated its efforts on the evolution of early maturing varieties of raya for zaid kharif sowings and ultimately succeeded in developing a new genotype.

The objective of the present study was to determine the agro-chemical behaviour of this new strain, RD-80, derived through pedigree selection from a cross between Poorbi raya and raya N.S (hugging type).

### MATERIALS AND METHODS

RD-80 and the two parental raya varieties, i.e. Poorbi raya and raya N.S., were evaluated during 1982-83 to 1984-85 at the experimental area of the Oilseeds Research Institute, Faisalabad. All studies were in a randomized complete block design with four replications and a plot size of 6.0 x 1.80m. The sowings were in the month of September of the relevant years in a well prepared moist seed bed. A seeding rate of 5 kg/ha was used. Sowings were done in rows 45 cm apart with the help of a hand drill. Plant-to-plant distance was maintained at 22.50 to 25.00cm by proper thinning, which was practised 15 days after emergence.

Data on days to emergence, the number of pods, seeds, branches and days to flowering were evaluated for three years, while oil content and fatty acid composition were evaluated only in 1983-84.

1. *Days to emergence* of the plants were recorded at 4-day intervals after sowing. When 50% of the seeds emerged, it was taken as the days to emergence.

2. *Number of branches/plant* were counted at the time of maturity and the average determined for five plants in each replication.

3. *Number of days to flowering.* The date of first flowering was when 10 % of the plants had flowered. The

\*PCSIR Laboratories, Lahore.

date of flower completion was when 90 % of the plants had flowered.

4. Number of pods/plant were counted on five plants in each replication at maturity.

5. Mean number of seeds/pod were counted for five pods on each of five plants at maturity.

6. One thousand seed weight was recorded after oven drying at 32°.

Table 1. Phenological characteristics of RD-80, Poorbi Raya, Raya N.S. (average of 1981-82 to 1983-84).

Variety	(Number of days)						Maturity
	Plant emergence	2-leave stage	4-leave stage	Main shoot emergence	Initial flowering	Final flower shedding	
RD-80	4	9	14	24	33	55	90
Poorbi Raya	5	10	16	29	38	62	105
Raya N.S.	5	11	18	30	40	60	110
LSD 0.05	N.S	N.S	N.S	N.S.	N.S.	N.S.	5.1359
LSD 0.01	N.S	N.S.	N.S.	UnS.	U.S.	N.S.	7.2006

Table 2. Morphological characteristics of RD-80, Poorbi Raya and Raya N.S. (average of 1982-83 to 1984-85).

Variety	Mean height per plant (cm)	Mean No. of branches per plant	Mean No. of pods per plant	Mean length of main shoot per plant (cm)	Mean length of pods per plant (cm)	Mean distance from pod to pod per plant (cm)	Mean No. of seeds per pod per plant	Mean 1000 seed weight (g)
RD-80	131	8.74	832	53.3	4.64	1.27	10	2.85
Poorbi Raya	141	8.20	667	70.0	4.50	1.54	9	2.24
Raya N.S.	143	8.40	674	59.0	4.43	1.35	9	2.52
LSD 0.05	N.S	N.S	52.0172	N.S.	N.S.	N.S.	N.S.	N.S.
LSD 0.01			72.9292					

Table 3. Seed yield and dry matter production of RD-80, Poorbi Raya and Raya N.S. (average of 1982-83 to 1984-85).

Variety	Seed yield kg/ha	Days of maturity	Mean yield kg/days
RD-80	2251.75	91	24.83
Poorbi Raya	2091.24	105	19.84
Raya N.S	1893.05	110	17.11
LSD 0.05	116.16	—	—
LSD 0.01	155.89	—	—

Table 4. Oil yield and physio-chemical characteristics of an early maturity *Brassica juncea* cultivar RD-80 (average of 1982-83 to 1984-85).

Character	RD-80	Poorbi raya	Raya N.S.
Oil content (%)	37.50	37.80	36.90
Glucosinolate (%)	0.50	0.37	0.45
Peroxide value (%)	1.39	1.39	1.21
Acid value	1.32	1.32	1.93
Saponification value	170.98	171.30	172.01
Ester value	169.66	170.50	170.06
Unsaponifiable matter	4.34	2.80	3.40
Iodine value	117.39	110.20	115.02

Table 5. Fatty acid composition of RD-80, Poorbi Raya and Raya N.S.

Variety	C 12:0	C 14:0	C 16:0	C 16:1	C 18:0	C 18:1	C 18:2	C 18:3	C 22:0	C 22:1	C 24:0
RD-80	0.22	0.33	3.61	0.60	1.08	18.13	25.43	4.46	1.21	50.41	0.25
Poorbi Raya	0.25	0.35	3.51	0.65	1.30	16.34	23.35	4.69	1.09	48.24	0.20
Raya N.S.	0.20	0.30	3.41	0.60	0.25	16.20	22.25	4.50	1.20	49.15	0.22

7. *The oil content* was determined from composite sampling by the Rooskovisky method. The dried and ground samples were weighed and packed in weighed filter paper. The samples were then put in the solvent (ether or petroleum) for 2-3 days, and the solvent was occasionally shaken and changed every day. Then the samples were put in a Soxhlet. The extractor was run for 3-4 hr. The samples were then taken out from the extractor, dried to a constant weight and weighed. The loss of weight so observed will be equal to the oil lost from the sample [7].

8. *Fatty acid composition.* Oil extractions were performed in hexane and all extracts were dried on sodium sulphate. The oil was hydrolyzed to the fatty acids either through saponification with alcoholic potassium hydroxide or converted to their methyl esters by treatment with methanol acetyl chloride, benzene (20:1:4) mixture directly. The methyl esters obtained were analysed by a gas chromatograph on a polyethene glycol succinate (PEGS) column using a PYE UNICAM model series 204 gas chromatograph. The identity and the percentage were determined from the retention time and the peak areas of their methyl esters respectively [2].

9. *Seed yield* of all the varieties/strains studied was calculated in kg/ha.

## RESULTS AND DISCUSSION

The results have clearly demonstrated that the new mustard cultivar RD-80 is an early maturing genotype. It was found to emerge, initiate flowering, and complete flower formation earlier than either of its parents (Table 1). It was also found to have profuse branching, increased number of pods and higher seed index (Table 2) resulting in higher seed yield (Table 3). Leopold [5] has reported that in many plant species, the completion of juvenile phase of growth has been found associated with early maturity. He has further indicated that attempts have been made to accelerate/stimulate plant emergence to obtain earliness through the use of growth regulators. In

the present studies it was observed that RD-80 seedlings emerged earlier than the parents. The ability of this new variety to emerge, flower and mature earlier makes it a suitable biotype for our cropping pattern. When sown in early September, it matures in 90 days. Thus the fields are vacant for normal wheat sowing of other oilseed crops in the same fields during ensuing spring.

The chemical composition and other constants like peroxide value, acid value, saponification value, ester value are almost at par with the existing approved variety Poorbi raya, except that unsaponifiable matter is more in the new genotype as compared to its parents. This increase in the unsaponifiable matter could be explained on the basis of different metabolic processes required for the formation of phytosterols which cause an increase or decrease in the value of unsaponifiable matter. However, these phytosterols have never been found injurious to human health. They might be the precursors of some useful products in the human biological system like califerols, tocoferols etc. On this basis it is plausible to assume that the new cultivar is acceptable in quality compared to its parents.

## REFERENCES

1. Anonymous, Report on Oilseeds Productions Strategy for Pakistan, Min. Fd. Agrar. Management, Islamabad, 1-9 (1977).
2. Anonymous, Development of Erucic Acid and Glucosinolate Free Rapeseeds (Crucifers) in Pakistan, 3rd. Res. Rep., P.C.S.I.R, Lahore, 1-83 (1983).
3. Anonymous, Agricultural Statistics of Pakistan, Min. of Fd. Agr. and Cooper., Islamabad, pp. 66-67.
4. Anonymous, Production Plan on Oilseeds, Agr. Dep. Govt. of the Punjab, pp. 1-7 (1985).
5. A.C. Leopold, *Plant Growth and Development* (McGraw-Hill Book Co., New York 1964), pp. 185-92.
6. S.A. Qureshi, *Strategy for Oilseeds*, (Min. of Fd. Agr. and Cooper., Govt. of Pakistan, Islamabad), pp. 1-44.
7. S.A. Khan, Report on the visit of Russia submitted to the Govt. of Punjab pp. 1-98 (1969).