

EVALUATIONS OF RADISH AND PECHAY CROPS FROM SEEDS LOCALLY PRODUCED AT MEDIUM AND HIGH ELEVATIONS

Otinggue M. Masnar

I. RADISH (*RAPHANUS SATIVUS* L.)

Radish (*Raphanus sativus* L.) is becoming popular among Filipinos. It grows anywhere in the Philippines in any season. This vegetable is rich in vitamins and minerals. It is eaten raw or boiled in combination with fish and meat or other vegetables.

In 1977, the total production of radish was 10,966 metric tons (BAECON, 1977). However, the national average yield is considerably low compared to other countries. Among other things, seed technology is not properly developed. Consequently, seed importation is essential for continuous vegetable planting ventures. Furthermore, the vigor of imported seeds declines rapidly under local conditions due to high temperatures and humidity (Figueroa, 1965). In many instances, radish growers were disappointed by the poor germination of their seeds which is more often a factor contributing to low yield. The country is also spending P486,000 annually for the importation of radish seeds.

Delgado and Dwyer (1978) claim that an expanded seed production, if properly supported both financially and technically, can make a major contribution to the provision of adequate food. Incidentally, local seed production technology is now gaining attention. It was demonstrated that a newly employed technique

such as vernalization, induced earlier flowering in radish (Aquino and Soriano, 1977; Soriano, Panaglima and Sy, 1978.) Just recently, Del Rosario and Labios (1980) reported that gibberellic acid sprays were also effective in inducing radish to flower earlier. At the moment, there is no commercial seed production ventures in the country in spite of its potentials. Millena and Soriano (1977) believed that the knowledge of the right methods and practices in seed production is still insufficient. Motivated towards advancement, radish seeds were produced from medium and high elevations in the Philippines. The performances of these seeds were evaluated in this study. The objectives of this study were to compare the marketable and seed yields of radish crops from seeds locally-produced at medium and high elevations and to evaluate the performance of this locally-produced seeds along with their imported parents and their immediate progenies.

Materials and Methods

Radish seeds cv. sixty days produced from Quezon (701 m above sea level) and Benguet (2439 m above sea level) were planted along with their imported parents on November 20, 1980 at Los Baños, Laguna. Each plot of 8 m² containing 106 plants was divided into fresh and seed yield data plants. The seed yield data plants were treated with gibberellic acid at 25 days after sowing at the rate of 150 ppm to induce earlier flowering. During the second experiment on April 3, 1981, seeds harvested from the first experiment, the immediate progenies, were included. Both experiments were direct seeded. Recommended cultural practices were applied. Both experiments were conducted using the Randomized Complete Block Design with three replications. Petri dish germination tests were undertaken using two groups of seeds. One group was stored in a standards seed storage chamber with a temperature of 10°C and a relative humidity (RH) of 60 percent. This was kept in this chamber since acquisition. The other group was stored in a germination chamber with a temperature of 40-

45°C and a higher RH. Higher RH was achieved by maintaining a pan of water inside the chamber. This was kept in this chamber for 8 days, just enough for accelerated aging.

The data collected were marketable yield, root length, root diameter, uniformity rating of marketable yield, number of harvested roots, non-marketable roots, seed yield, uniformity rating of flowering, plant height at flowering, number of days to 50 percent flowering and seed maturity, insect pest and disease damage ratings, 100-seed weight and percent and rate of germination.

Results and Discussion

Except for the germination in petri dishes which were highly significantly different among treatments (Table 4), all other parameters measured were not significant (Tables 1, 2 and 3).

Low germination percentages of seeds stored in a standard seed storage chamber (10°C and 60% RH) were observed in all progenies. This was probably due to dormancy since the seeds were less than a month old during the germination tests. Mamicpic (1981)¹ noted a low germination percentage of one-month-old radish seeds. He further observed that maximum germination percentage was achieved three months after seed harvest.

The seeds that originated from Quezon and Benguet as well as their imported parent did not show significant differences in percent germination in petri dishes. On the other hand, the lowest germination percentage among seeds exposed to a high temperature and humidity in a germination chamber was obtained from imported seeds. The highest germination percentage was observed from the progeny of imported seeds. Three other treatments did not differ from the progeny of imported seeds.

The rates of germination of seeds exposed in a standard seed storage chamber (10°C and 60% RH) were highly significantly different among treatments as shown in Table 4. The highest rate of 1.5 mean day was noted in Quezon-originated seeds. Imported seeds did not differ from this treatment. All progenies showed

slower rates of germination as compared to the parents. There were no significant differences in germination rate among progenies.

The rates of germination of seeds exposed in the germination chamber (40-45°C and higher RH) were significantly different among treatments (Table 4). Imported seed had the lowest rate of germination. Quezon-produced seeds and its progeny as well as Benguet-originated seed did not differ significantly from imported seed.

The higher germination percentage observed from seeds stored in the germination chamber (40-45°C and higher RH) was possibly due to the breaking of seed dormancy. Copeland (1976) pointed out that seed dormancy of some species may be broken by a short period of exposure to high temperatures.

Lower marketable yields were produced during the second experiment because of shorter and smaller roots which consequently had reduced weights. This was attributed to higher growing temperatures, which did not provide optimum conditions for the development of storage roots. Radish can be grown throughout the year in the experiment stations but more favorable yields are obtained during cool seasons.

The seeds harvested were low as a result of heavy damages incurred by insect pests.

Conclusion

It is concluded that seeds of radish that originated from Quezon and Benguet were as good as their imported parents and their immediate progenies in marketable and seed yield performances as well as in crop uniformity.

Germination percentages and rates of imported radish seeds stored at higher temperatures and humidity were lower possibly due to age factor. Poor germination of all seeds harvested from the first experiment is associated with dormancy, being fresh from harvest.

MASNAR: RADISH AND PECHAY/7

Table 1. Marketable yield, root length, root diameter and uniformity rating of marketable yield of radish crops growth from locally-produced seeds, first experiment.¹

SEED ORIGIN	MARKETABLE YIELD (ton/ha)	YIELD (gm/plt)	ROOT LENGTH (cm)	ROOT DIAMETER (cm)	UNIFORMITY RATING OF MARKETABLE YIELD ^a
Imported check	39.5	354.0	17.6	5.8	3.6
Quezon	44.0	359.3	17.5	5.7	3.6
Benguet	44.0	380.3	18.6	5.6	3.2
Mean	42.5	364.5	17.9	5.7	3.5
C.V. (%)	6.1	3.8	3.4	1.7	6.7

¹There were no significant differences among treatments in all data taken.

^aRating scale: 5 for the most uniform and 1 for the least uniform.

Table 2. Marketable yield, root length, root diameter and uniformity rating of marketable yield of radish crops grown from locally-produced seeds, second experiment.

SEED ORIGIN	MARKETABLE YIELD (ton/ha)	YIELD (gm/plt)	ROOT LENGTH (cm)	ROOT DIAMETER (cm)	UNIFORMITY RATING OF MARKETABLE YIELD ^a
Imported check	13.4	307.6	16.4	5.6	2.5
Quezon	10.8	287.3	16.2	5.3	2.8
Benguet	13.3	308.0	16.6	5.6	2.5
Progeny of imported	13.6	273.7	16.0	5.4	2.7
Progeny of Quezon	11.9	271.7	15.0	5.4	2.7
Progeny of Benguet	12.8	287.0	16.6	5.2	2.5
Mean	12.6	289.2	16.1	5.4	2.6
C.V. (%)	8.6	5.4	3.7	2.9	5.1

¹There were no significant differences among treatments in all data taken.

^aRating scale: 5 for the most uniform and 1 for the least uniform.

Table 3. Seed yield and uniformity rating of flowering of radish crops growth from locally-produced seeds, first experiment.¹

SEED ORIGIN	SEED YIELD		UNIFORMITY RATING OF FLOWERING ^a
	(kg/ha)	(gm/plt)	
Imported check	56.7	0.8	3.3
Quezon	52.4	0.8	3.0
Benguet	51.9	1.0	3.3
Mean	53.6	0.9	3.2
C.V. (%)	4.9	13.3	5.4

¹There were no significant differences among treatments in all data taken.

^aRating scale: 5 for the most uniform and 1 for the least uniform.

Table 4. Percent and rate of germination in petri dishes of locally-produced radish seeds stored at standard seed storage conditions (10°C and 60% RH) and high (40-45°C) storage temperatures and RH.¹

SEED ORIGIN	PERCENT	GERMINATION	RATE OF GERMINATION	
	Standard Storage Conditions	High Storage Temperatures and RH	Standard Storage Conditions	High Storage Temperatures and RH
	(%)	(%)	(mean day)	(mean day)
Imported check	93.3 ^a	54.0 ^c	1.9 ^b	2.1 ^b
Quezon	94.6 ^a	88.7 ^a	1.5 ^a	1.7 ^{ab}
Benguet	93.0 ^a	75.3 ^b	1.9 ^b	2.0 ^b
Progeny of imported	52.3 ^b	93.3 ^a	2.3 ^c	1.4 ^a
Progeny of Quezon	52.7 ^b	88.3 ^a	2.2 ^c	1.6 ^{ab}
Progeny of Benguet	52.7 ^b	88.0 ^{ab}	2.3 ^c	1.5 ^a
Mean	73.1	81.3	2.0	1.7
C.V. (%)	30.7	18.0	15.4	16.2

¹Within columns, means with uncommon letters are significantly different at 5% level using DMR test of significance.

II. PECHAY (*BRASSICA CAMPESTRIS* L. SUBSP. *CHINENSIS*)

Pechay (*Brassica campestris* L. subsp. *chinensis*) is one of the most important vegetable crops in the Philippines, both nutritionally and economically. In 1977 the total production was 42,239 metric tons (BAECON, 1977).

Inadequate supply of good quality seeds has been one of the most important limitations in growing this crop. Pechay growers depend mostly on imported seeds. More often, low yields are obtained due to a poor and non-uniform crop stand. This situation calls for a system of local seed production.

Local seed production in pechay was earlier studied by Aljas (1956) who harvested 140 and 51 kg of seeds per hectare during the dry and the rainy seasons, respectively. Figueroa (1965) made another study and harvested 13.6 to 28.0 gm of seeds per plant. In a recent finding, a newly employed technique, specifically vernalization, induced earlier flowering by as much as 98 percent (Millena and Soriano, 1977). Other methods of inducing earlier flowering such as gibberellic acid (GA_3) sprays were proven effective by Del Rosario and Labios (1980).

In spite of these achievements in pechay seed production, there is no literature that can show the performance of locally-produced seeds. Thus, evaluation of locally-produced seeds that originated from low, medium and high elevations was undertaken. Specifically, the objectives of this study were to compare the fresh and the seed yields of pechay crops from seeds locally-produced at different elevations and to evaluate the performance of these locally-produced seeds along with their immediate progenies and imported parents.

Materials and Methods

Pechay seeds cv. black behi produced from Batangas (11 m. above sea level), Quezon (701 m. above sea level) and Benguet (2439 m. above sea level) were planted along with their imported

parents on November 20, 1980 at Los Baños, Laguna. Each plot of 8 m² containing 106 plants was divided into fresh yield data and seed yield data plants. The seed yield data plants were treated with gibberellic acid at 25 days after sowing at the rate of 150 ppm to induce earlier flowering. During the second experiment on April 3, 1981, seeds harvested from the first experiment, the immediate progenies, were included. Both experiments were direct-seeded. Recommended cultural practices were applied. Both experiments were conducted using the Randomized Complete Block Design with three replications. Petri dish germination tests were also undertaken using two groups of seeds. One group was stored in a standard seed storage chamber with a temperature of 10°C and a relative humidity (RH) of 60 percent. This was kept in this chamber since acquisition. The other group was stored in a germination chamber with a temperature of 40-45°C and a higher RH. Higher RH was achieved by maintaining a pan of water inside the chamber. This was kept in this chamber for 8 days, just enough for accelerated aging.

The data collected were fresh yield, uniformity rating of fresh yield, seed yield, uniformity rating of flowering, number of seeds per pod, number of harvested seed-plants, number of days to 50 percent flowering and 50 percent seed maturity, insect pest and disease damage ratings, one thousand-seed weight and percent and rate of germination.

Results and Discussion

Fresh yield. The treatments did not differ significantly in yields per hectare and per plant as shown in Tables 1 and 2. Similar yield trends were noted in two experiments, but higher yields were recorded during the second experiment. This may be due to insufficient water supply during the first experiment. In the second experiment, the close proximity of the experimental plots to a faucet permitted daily watering which maintained the soil in good moisture condition. Weed competition during early growth of plants in the first experiment was also a problem because of the

prevalence of rainy weather prior to and during sowing of seeds which enabled weeds, particularly *Cyperus rotundus*, to establish in the field.

Uniformity rating. There were no significant differences observed among treatments in uniformity ratings of fresh yields (Tables 1 and 2) and of flowering (Table 3). This is an indication that plants grown from locally-produced seeds were as uniform as the plants grown from their imported parents and immediate progenies. The apparent high visual rating is a manifestation of low variability.

Seed yield. Seed yields per hectare were not significantly different among treatments but differences in seed yields per plant were significant (Table 3). The highest seed yield (6.3 gm/plant) was taken from plants grown from imported seeds. The lowest seed yield (5.2 gm/plant) was obtained from plants grown from seeds that originated from Benguet. The seeds that originated from Batangas and Quezon did not differ from imported seeds.

Significant differences in seed yield per plant was probably due to differences in number of seeds per pod. It was noted that greater seeds per pod resulted in higher seed yield per plant. The two parameters showed a correlation coefficient of 0.8, indicating their close relationship.

In spite of significant differences in seed yields per plant, seed yields per hectare were not significantly different. This was due to differences in number of harvested seed plants. The two parameters had a correlation coefficient of 1.0.

Mamicpic¹ (1981) harvested higher seed yield per hectare from plants grown at high elevations than those at low and medium elevations. He further pointed out that low seed yields per hectare obtained from plants grown at low and medium elevations were due to heavy damages of insect pests. Consequently, there is a suspicion that elevation has no considerable influence on seed yield per hectare. This experiment, being conducted at low elevation, showed that seed yields per hectare were comparable to those obtained by Mamicpic at high elevations.

Number of seeds per pod and number of harvested seed plants. In spite of the greatest number of seeds per pod harvested from plants grown from imported seeds, statistical analysis indicated no significant differences among treatments. Similarly, the treatments did not significantly differ in number of harvested seed plants although lesser plants were gathered from Benguet-originated seeds.

Number of days to 50 percent flowering and 50 percent seed maturity. No significant differences were noted among treatments in number of days to 50 percent flowering and 50 percent seed maturity as presented in Table 4.

Insect pest and disease damage ratings. There was no apparent insect damage among plants used for fresh yield data in the first experiment. Plants used for seed yield data in the first experiment (Tables 4) and plants used for fresh yield data in the second experiment (Table 5) were damaged by insect pests. However, no significant differences were observed among treatments. Both experiments were not infected by diseases.

One thousand-seed weight. Differences among treatments were highly significant (Table 5). The heaviest weight of 2.0 gm was observed in seeds that originated from Quezon and Benguet. The seeds that originated from Batangas (1.9 gm) did not differ from these treatments. The highest weight of 1.4 gm was measured from imported seeds. Four other treatments were not significantly different from imported seeds.

Percent and rate of germination. The percent germination in the field did not differ significantly among treatments. However, the differences in percent germination in petri dishes were highly significant among treatments (Table 6). The lowest percent germination was exhibited by imported seeds. All progenies and other locally-produced seeds did not show significant differences.

The germination rates of seeds stored in a standard seed storage chamber (10°C and 60% RH) were not significantly differ-

ent among treatments (Table 6). However, the germination rates of those exposed to higher temperature (40-45°C) and RH were highly significantly different among treatments (table 6). The lowest germination rate of 1.5 mean day was observed in imported seeds. All other treatments were not significantly different from each other.

The low germination percentage and rate obtained in imported seeds is attributed to temporary exposures to tropical ambient temperatures during transit and local distribution.

Conclusion

It is concluded that seeds of pechay that originated from Batangas, Quezon and Benguet were as good as their imported parents and their immediate progenies in fresh and seed yields per hectare and in crop uniformity.

Germination percentages and rates in petri dishes of imported pechay seeds were lower than that of locally-produced ones, possibly due to direct exposure in tropical conditions during transit and local distribution.

FOOTNOTES

¹N.G. Mamicpic, Associate Professor, University of the Philippines at Los Banos (personal communication).

Table 1. Fresh yields and uniformity rating of fresh yield of pechay crops grown from locally-produced seeds, first experiment¹.

SEED ORIGIN	FRESH YIELDS		UNIFORMITY RATING OF FRESH YIELD ^a
	(ton/ha)	(gm/plt)	
Imported check	9.5	83.0	4.0
Batangas	10.3	88.3	3.6
Quezon	12.1	99.3	3.0
Benguet	9.3	81.3	3.3
Mean	10.3	87.9	3.5
C.V. (%)	11.9	9.2	12.2

¹There were no significant difference among treatments in all data taken.

^aRating scale: 5 for the most uniform and 1 for the least uniform.

Table 2. Fresh yields and uniformity rating of fresh yield of pechay crops grown from locally-produced seeds, second experiment¹.

SEED ORIGIN	FRESH YIELDS (ton/ha)	RATING OF (gm/plt)	UNIFORMITY RATING OF FRESH YIELD ^a
Imported check	11.5	164.7	4.0
Batangas	14.6	176.3	4.0
Quezon	16.4	196.3	4.0
Benguet	13.0	169.0	3.8
Progeny of imported	18.0	194.3	4.0
Progeny of Batangas	17.2	176.7	4.1
Progeny of Quezon	14.0	192.0	3.7
Progeny of Benguet	14.4	175.7	4.2
Mean	14.9	180.6	4.0
C.V (%)	14.7	6.6	3.9

¹There were no significant differences among treatments in all data taken.

^aRating scale²5 for the most uniform and 1 for the least uniform.

Table 3. Seed yields and uniformity rating of flowering of pechay crops grown from locally produced seeds, first experiment¹.

SEED ORIGIN	SEED YIELDS	UNIFORMITY RATING OF	SEED YIELDS	UNIFORMITY RATING OF
	(kg/ha)		(gm/plt)	FLOWERING ^a
Imported check	519.3 ^a		6.3 ^a	3.5 ^a
Batangas	552.0 ^a		5.8 ^{ab}	3.5 ^a
Quezon	545.0 ^a		6.2 ^a	3.5 ^a
Benguet	396.6 ^a		5.2 ^a	3.3 ^a
Mean	503.2		5.8	3.4
C.V. (%)	14.3		8.5	2.9

¹Within columns, means uncommon letters are significantly different at 5% level using DMR test of significance.

^aRating scale: 5 for most uniform and 1 for the least uniform.

Table 4. Number of days to 50 percent flowering, number of days to 50 percent seed maturity, and insect pest damage rating of pechay crops grown from locally-produced seeds, first experient.¹

SEED ORIGIN	NUMBER OF DAYS TO 50 PERCENT FLOWERING	NUMBER OF DAYS TO 50 PERCENT SEED MATURITY	INSECT PEST DAMAGE RATING^a
Imported check	59.6	92.0	1.4
Batangas	58.7	90.4	1.6
Quezon	58.7	93.3	1.3
Benguet	63.3	95.3	1.8
Mean	60.1	92.7	1.5
C.V. (%)	3.6	2.2	14.5

¹There were no significant difference among treatments in all data taken.

^aRating scale: 1 for none or very slight damage and 5 for very heavy damage.

Table 5. Insect pest damage rating of the second experiment and one thousand-seed weight of peachay crops grown from locally-produced seeds.

SEED ORIGIN	INSECT PEST DAMAGE RATING ^a	1000-SEED WEIGHT (GM)
Imported check	1.7 ^a	1.4 ^b
Batangas	1.5 ^a	1.9 ^a
Quezon	1.7 ^a	2.0 ^a
Benguet	1.7 ^a	2.0 ^a
Progeny of imported	1.3 ^a	1.6 ^b
Progeny of Batangas	1.3 ^a	1.6 ^b
Progeny of Quezon	1.8 ^a	1.6 ^b
Progeny of Benguet	1.7 ^a	1.5 ^b
Mean	1.6	1.7
C.V. (%)	12.3	13.7

¹ Within columns, means with uncommon letters are significantly different at 5 % level using DMRT test of significance.

^a Rating scale: 1 for none or very slight damage and 5 for very heavy damage.

Table 6. Percent and rate of germination in petri dishes of locally-produced pechay seeds exposed at standard seed storage conditions (10°C and 60% RH) and higher (40-45°C) storage temperatures and RH

	Standard Storage Conditions	Higher Storage Temperature & RH	Standard Storage Conditions	Higher Storage Temperature & RH
	(%)	(%)	(mean/day)	(mean/day)
Imported check	92.3 ^b	90.3 ^b	1.4	1.5 ^b
Batangas	99.0 ^a	99.3 ^a	1.1	1.0 ^a
Quezon	99.3 ^a	98.3 ^a	1.2	1.1 ^a
Benguet	99.3 ^a	99.3 ^a	1.1	1.1 ^a
Progeny of imported	98.3 ^a	98.0 ^a	1.2	1.0 ^a
Progeny of Batangas	98.3 ^a	97.6 ^a	1.2	1.1 ^a
Progeny of Quezon	98.3 ^a	98.6 ^a	1.2	1.1 ^a
Progeny of Benguet	98.3 ^a	98.6 ^a	1.2	1.1 ^a
Mean	97.8	97.5	1.2	1.1
C.V. (%)	6.1	2.3	7.7	14.7

Within columns, means with uncommo letters are significantly different at 5% level using DMR test of significance.

I. RADISH

LITERATURE CITED

- Aquino, P. and J.M. Soriano. 1977. Nitrogen fertilization and flower induction in radish seed production. Proc. 12th Workshop-Seminar, Soc. Adv. Veg. Ind., Philippines, November 1977, Los Banos, Laguna.
- Bureau of Agricultural Economics. 1977. Crop statistics for 1977. Quezon City, Philippines.
- Copeland, L.O. 1976. Principles of seed science and technology. Minnesota: Burgess Publishing Co., p. 75-87.
- Del Rosario, D.A. and E. Labios. 1980. Applied seed production studies for low, medium and high elevations. Unpublished semi-annual report, Philippine Council for Agriculture Research and Resources, Los Banos, Laguna.
- Delgado, C.R. and J.A. Dwyer. 1978. Vegetable seed production in Philippine vocational agricultural schools – It's potential contribution to countryside development. Proc. 13th Workshop-Seminar, Soc. Adv. Veg. Ind., Philippines, October 1978, Cagayan de Oro City.
- Figueria, W. Jr. 1965. Seed production of pechay, lettuce and mustard. Unpublished B.S. Thesis, University of the Philippines at Los Banos, College, Laguna.
- Millena, W.D. and J.M. Soriano. 1977. The effects of vernalization, gibberellic acid and nitrogen levels on seed production of pechay. Proc. 12th Workshop-Seminar, Soc. Adv. Veg. Ind., Philippines, November 1977, Los Banos, Laguna.
- Soriano, J.M., Z.B. Panaglma and E. Sy. 1978. Flower induction in pechay and radish. Proc. 13th Workshop-Seminar, Soc. Adv. Veg. Ind., Phils., October 1978, Cagayan de Oro City.

II. PECHAY

LITERATURE CITED

- Aljas, J.P. 1956. Seed production of pechay. Unpublished B.S. Thesis, UPLB.
- Bureau of Agricultural Economics. 1977. Crop statistic for 1977, Quezon City, Philippines.
- Del Rosario, D.A. and E. Labios. 1980. Applied seed production studies for low, medium and high elevations. Unpublished semi-annual report in PCARR, 37 p.
- Figuroa, W. Jr. 1965. Seed production of pechay, lettuce and mustard. Unpublished B.S. Thesis, UPLB.
- Millena, W.D. and J.M. Soriano. 1977. The effects of vernalization, gibberilic acid and nitrogen levels on seed production of pechay. SAVI Proc.