

EVALUATION OF HEAT TOLERANT CHINESE CABBAGE (*Brassica pekinensis* Rupr.) UNDER DRY SEASON CONDITIONS

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Chinese cabbage (*Brassica pekinensis* Rupr.) is a good source of income due to its high market demand making it a very valuable crop. It is also a good source of vitamins and minerals for the human body. Sufficient production on this crop will not only promote proper nutrition but most importantly will contribute in achieving enough food supply for the growing population of the country. With 48 million Filipinos, it is estimated that 4.8 million tons of vegetables should be produced annually to satisfy normal requirements.

Despite the advancement in the country's vegetable production technology, not all locations in the place can be potential sites for vegetable production. Many vegetable crops are selective in terms of environmental conditions. Chinese cabbage for instance is a temperate crop, hence, suitable only in places with relatively cool climates. However, breeding efforts through the years have resulted in the production of heat tolerant cultivars which can be grown under the tropical climate with satisfactory heading ability.

A cool season planting in December at Los Banos, Laguna, of 20 lines and cultivars showed that only 15.7 tons per hectare can be obtained as the highest yield (Hubbel,, 9177). On the other hand, only 2.9 tons per hectare can be produced if these are planted during drought conditions in March. The poor perform-

ance of Chinese cabbage in the tropics is accounted for the high temperatures that generally present greater environmental stress particularly on cultivars without heat tolerance (AVRDC, 1977). When the climate is favorable particularly during winter in Taiwan, the yield can be as high as 63 tons/ha (AVRDC, 1976).

Under Philippine tropical conditions, Baguio is noted to be an ideal site for the production of cabbages because the cool temperatures permit planting all throughout the year. Due also to the prevalence of cool climate, the MSU campus and vicinity can have a good prospect for cabbage production. The possibility of growing common cabbage in this location all the year round is obvious, thus, Chinese cabbage, a close relative, may be expected to perform well under these conditions.

On this assumption, the first planting of this crop in this locality was initiated. Specifically, it was aimed to evaluate the performance of heat-tolerant lines under "dry summer" conditions in MSU, Marawi City. It was conducted during these conditions so that maximum temperature stress with respect to local environmental conditions can be provided.

Materials and Methods

The experiment was conducted at the Research Area of the College of Agriculture, MSU, Marawi City, from March 1 May 22, 1978. The experiment consisted of ten entries using 8 Chinese cabbage heat-tolerant lines and 2 other heat tolerant cultivars. The seeds were developed from the Asian Vegetable Research and Development Center, Taiwan, ROC. Each plot was composed of 24 plants using the inner 20 plants as the experimental unit.

A. *Treatments.* The ten entries used in this experiment were the following :

- 1) 76 M(1) - 4
- 2) 76 M(1) - 6

- 6) 76M(2) - 18
- 7) 76 M (2) - 20

3) 76 M(1) - 12

4) 76 M (2) - 16

5) 76 M(2) - 17

8) 7281 AG 5 - 1

9) B 189 C₁(11) check A

10) B 129 C₁ (11) check B

B. *Experimental design.* The experiment was conducted in randomized complete block design (RCBD) with 3 replications.

C. *Sowing.* The seeds were sown in a seedbed containing a mixture of 2/3 ordinary garden soil and 1/3 decomposed cattle manure. Two seeds were sown per hill at 5 cm interval. Thinning was done 5 days after germination.

D. *Transplanting.* Seedlings were transplanted in a well-prepared land 24 days after sowing. The distance of planting was 75 cm between rows and 40 cm between plants within rows.

E. *Fertilizer application.* Fertilizer was applied at the rate of 200-80-150 kg/ha of N, P₂O₅ and K₂O, respectively. All the required P, K and 40 per cent of N were incorporated into the soil at transplanting. The other N requirement was split into 3 side dressings at 9, 23 and 30 days after transplanting. Cattle manure was applied during transplanting at the rate of 200 gm per hill.

F. *Maintenance of experimental plots.* Insect pests were controlled by spraying Hosthathion and Vegetox alternately at weekly interval. Dithane M-45 was also used to protect the plants from disease damage. Weeding operations were done whenever necessary. The soil was kept in good moisture conditions by watering at 3 days interval.

G. *Harvesting.* The heads were harvested on May 16 and 22, 1978. Only compact and firm heads were harvested. The data collected were the following:

1. ***Plot yield.*** Total weight of marketable heads in a plot of 20 plants. The yield per plot was converted into tons per hectare.

2. ***Maturity.*** Number of days from transplanting to 50 per

cent plot harvest.

3. *Head weight.* The individual head weight of 20 plants. The mean head weight was determined.

4. *Vegetative weight.* This term refers to the whole plant weight including the head and non-wrapper leaves. The mean vegetative weight was computed.

5. *Number of non-wrapper leaves (NWL).* The number of leaves not making up the head were presumably active organs of photosynthesis. This was taken from 20-plant samples used in item 1 above. The mean number of non-wrapper leaves was recorded.

6. *Weight of non-wrapper leaves.* Taken as the difference between items 4 and 3. The mean weight of non-wrapper leaves was determined.

7. *Heading rate.* The percentage of plants in a plot which formed solid, harvestible heads during the duration of the experiment. Soft rot-infected, TuMV-infected plants and those with abnormally delayed growth were disregarded.

8. *Heading efficiency.* The ratio of mean head weight to mean weight of non-wrapper leaves.

9. *Bolting frequency.* The percentage of plants in a plot which flowered prematurely.

10. *Diseases and insect pests damage rating.*

a) soft rot - per cent infection per plot

b) virus - per cent infection per plot

c) downy mildew - subjective rating (1-4 scale)

d) insect damage - subjective rating (1-4 scale)

Results and Discussion

Marketable yield. The yields of half of the entries were significantly higher than the yield of check A cultivar (Table 1). The yields of the other half were also higher than the yield of this check cultivar but their variations were not statistically significant. On the other hand, only lines 76 M(1) - 4 and 76 M(2) - 17 pro-

duced a significantly higher yields over check B cultivar. It was evident that the highest yield of 27 tons per hectare was obtained from plots grown with line 76 M(2) - 17 while the lowest yield of 16.4 tons/ha was harvested from plots planted to check A cultivar.

The higher yields demonstrated by some lines can be accounted for heavier vegetative weight and consequently greater head weight. This might be associated by the ability of these plants to form compact heads under local conditions. It should be borne in mind that these higher yields under our tropical conditions are good indications that Chinese cabbage will perform satisfactorily in MSU and vicinity, hence, it would have a greater contribution in our agriculture.

Maturity. The two check cultivars were significantly more early maturing than any of the other entries (Table 1). The latest

Table 1. Marketing yield, maturity, mean head weight and mean vegetative weight and mean vegetative weight in Chinese cabbage

Entries	Yield (ton/ha)	Maturity (days)	Mean Head weight (gm)	Mean vegetative weight (gm)
76 M(1)-4	24.5	46.0	878.5	1560.0
76 M(1)-6	20.8	48.0	784.0	1436.0
76 M(1)-12	17.2	46.0	662.5	1242.5
76 M(2)-16	18.6	46.5	667.0	1276.5
76 M(2)-17	27.0	44.5	1047.0	1776.0
76 M(2)-18	17.8	47.0	656.0	1109.0
76 M(2)-20	19.2	46.5	709.0	1491.0
7281 AG 5-1	18.4	47.0	700.5	1238.5
B 189 C ¹ check A	16.4	40.5	620.5	970.5
B 129 C ¹ (II) check B	18.5	41.5	719.0	1211.0
MEan	19.8	45.3	744	1331.1
CV (%)	17.1	5.4	17.4	17.7
LSD .05	2.63	1.69	69.5	68.7

significantly maturing crop of 48 days was observed from line 76 M(1) - 6.

If the normal maturity of Chinese cabbage under temperate conditions takes about 60 days, the latest maturing line in this experiment can be regarded to be early because it took only 48 days. However, it is a common observation that the maturity of crops is shortened under relatively hot conditions. The advantage offered by early maturing crop is lower cost of production and more cropping per unit of time.

Mean head weight. The mean head weight differences among entries were highly significant (Table 1). The significantly heavier head weight of 1,047 gm was harvested from line 76 M(2) - 17. However, three of the entries such as: 76 M(1) - 12, 76 M(2) - 16 and 76 M(2) - 18 did not vary significantly with check A cultivar while six of them were not also significantly different from check B cultivar.

The plants with heavier head weight were the same plants that produced higher marketable heads. The heads of these plants were very compact, which may account for a heavier weight.

Mean vegetative weight. The differences in mean vegetative weight were highly significant (Table 1). The mean vegetative weight of lines 76 M(1) - 4, 76 M(1) - 6, 76 M(2) - 17 and 76 M(2) - 20 were highly significantly greater than that of both check cultivars. The vegetative weight of four other entries were also significantly heavier than that of check A cultivar but were insignificantly different with that of check B cultivar.

The plants appearing larger were the ones that gave greater vegetative weight. Consequently, these plants were also heavier in head weight to give higher marketable yields.

Mean number of non-wrapper leaves. There was no significant variation in the number of non-wrapper leaves (Table 2). In spite of this observation, the differences in mean head weight and mean vegetative weight were found to be significant. However, it was noted that the weight of non-wrapper leaves was

variable. This can indicate that the main factor of variability was the size of leaves.

Mean weight of non-wrapper leaves. The variation among entries was highly significant (Table 2). Except for line 76 M(2) - 18, which did not show significant variation with check B cultivar, all treatments exhibited significantly heavier weight of non-wrapper leaves than the two check cultivars. This difference was due to leaf size. It was noted that bigger size leaves weighed heavier than small size leaves.

Table 2. Mean number of non-wrapper leaves (NWL), mean weight of NWL, heading rate and heading efficiency in Chinese cabbage.

Entries	Mean no. NWL	Mean wt. NWL (gm)	Heading rate (%)	Heading efficiency
76 M(1)-4	14.2	681.0	100	1.29
76 M(1)-6	15.9	697.5	95	1.14
76 M(1)-12	15.4	623.5	93	1.07
76 M(2)-16	15.0	607.5	98	1.11
76 M(2)-17	19.8	782.5	98	1.34
76 M(2)-18	13.2	452.0	100	1.47
76 M(2)-20	14.9	789.5	100	0.90
7281 AG 5-1	15.2	537.5	100	1.31
B189 C ¹ (II) check A	13.2	352.5	100	1.76
B129 C ¹ (II) check B	15.3	492.0	100	1.47
Mean	15.2	601.5	98.4	1.28
CV (%)	12.2	23.8	2.5	19.21
LSD	NS	43.2	NS	0.17

NS - non significant

Heading rate. There was no significant differences in heading rate (Table 2). All entries demonstrated high percentages of heading rate. The head that were formed were very compact and marketable.

Heading efficiency. There was significant variation in heading efficiency (Table 2). However, the heading efficiency of check

cultivars was significantly higher than any of the entries except for lines 76 M(2) - 17, 76 M(2) - 18 and 7281 AG 5-1 which did not vary significantly with check B cultivar.

Bolting frequency. It was observed that not a single plant in any of the entries flowered prematurely.

Diseases and insect pests damage rating. There was no disease that occurred except for soft rot which was noted in the check cultivars and four of the other entries. However, the incidence was very low, less than 10 per cent. Moreover, a physiological disorder known as tipburn was observed in almost all in check B cultivar. On the other hand, insect damage was very low and that no significant variation was noted.

Conclusion

It is concluded that Chinese cabbage heat tolerant lines included in this experiment performed well under MSU conditions during the dry season. It was noted that some lines even produced greater yields than the check cultivars. The prevailing high temperature and dry periods during the conduct of the experiment were considered sufficient environmental stress, hence, it is believed that these lines are capable for producing marketable heads in any planting season.

The Mindanao State University campus and vicinity can also be considered ideal production site for Chinese cabbage due to the prevalence of cool climate that will permit planting any time of the year.

Literature cited

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