BIBLIOGRAPHY

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ABSTRACT

A study on the performance of Chinese cabbage varieties, namely: Green Cool, Taibyo Nozomi, Vigor 60, CR-Jinshim F_1, CR-Nongsaim F_1, Summer Star F_1, and Blues F_1 was undertaken under La Trinidad, Benguet.

Results revealed that Blues F_1 significantly had the highest average head weight of 1.088g and marketable yield at 60.975 t/ha and had the longest shelf-life of 40 days under room condition at an average temperature of 13° C.

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INTRODUCTION

Chinese cabbage is considered by Larkcom (2004) as among the trickiest vegetables to grow. They can develop at a phenomenal rate but they demand the best growing conditions. They are superb, healthy looking plants but susceptible to pests. While Dimsey and Barton (1997) stated that Chinese cabbage is not a true cabbage but belongs to the mustard group. It originated in China as a cross between pack choi and turnip. It is a fast growing vegetable that is in demand for export and for domestic market. It is considered as the most consumed vegetable in China and a major vegetable crop in Japan.

Generally grown Chinese cabbage is like large lettuces or cabbages but with a crisp watery texture and mustard-like taste. Both round and elongated varieties have solid hearts; open leafy varieties has broad stalks, and the self blanching variety " Eskimo" looks like a large endive with a white heart. They can be eaten either raw or cooked (Phillips and Rix, 1993).

Ware and Collum (1980) noted that Chinese cabbage (*Brassica chinensis* or *pekinensis*) is more closely related to Mustard than cabbage. It is variously called Choy, Chihili, Michili, Wong Bok, and popularly known as celery cabbage, although it is unrelated to celery.

According to Magallona as cited by an anonymous author (1981) Chinese cabbage is only a minor crop in the Philippines, which is generally over shadowed by common cabbage that is also grown in the high elevation areas. Its close relative, petsai (*B. campestris* ssp. *chinensis*) is widely grown both in the high and low elevation areas.

Several varieties of Chinese cabbage are grown in the locality but their yield performance need to be evaluated.

Chinese cabbage is mainly cultivated in the highland areas where the low temperatures are favorable. The common cabbage (*B. oleracea L* var *capitata L.*) is the predominant crucifer and the production data of Chinese cabbage is often lump together with the common cabbage. In Northern Luzon, Benguet is the main area for Chinese cabbage production that supplies urban centers in the country, especially Metro Manila and other cities and provinces.

Benguet is one of the major producers of vegetables in the country but due to lack of information, farmers fail to select appropriate varieties that are high yielding, disease and insect resistant, and adapted to seasonal environment stresses.

The study aimed to evaluate the yield performance of the different Chinese cabbage varieties and determine the Chinese cabbage variety/varieties that perform well under La Trinidad, Benguet condition.

The study was conducted in Balili Experiment Farm, Benguet State University from October to February 2008.

REVIEW OF LITERATURE

Brassica rapa

Childers *et al*, (1950) stated that Chinese cabbage can be transplanted like head cabbage but excellent results have been obtained by planting the seed directly in the field then later thinned to one good plant at 10 to 12 cm. They should be kept growing rapidly by a side dressing of nitrogen or complete fertilizer. The heads are harvested when solid and from 6 to 8" across. Chinese cabbage is one of the easiest and most productive vegetables grown in the tropics. Where the greens, celery and head cabbage are scarce, Chinese cabbage is popularly used as chopped salads for those accustomed to eating leafy vegetables. It can be grown all year, but it forms the largest and best quality heads during cool season and forms loose heads during dry season.

Cultivation

The use of hydrosorb (0.5 kg) as a pretreatment of Chinese cabbage seedlings before transplanting can increase percentage survival and a 2 day irrigation interval is economical (Gurung, 1991).

Varieties grown as young greens or small flowering plants are easy to cultivate which require only ample water, rich soil and warm temperature. They do well at high temperatures. The large heading Chinese cabbage with a dense, white crunchy heart (*Brassica rapa* subsp. pekinensis) is more difficult to grow well. They grow best in cooler temperatures. Ample water and rich soil is the key to successful cultivation. Seeds are best sown singly in pots or sown *in situ* and thinned to 30 cm apart and they become tough and drought-resistant as ordinary cabbage. Harvest may be from forty-five days

onwards, according to the variety and temperature. 'Spring A-I', are bolt-resistant and suitable for spring sowing in cool climates (Phillips and Rix, 1993).

Climate

Chinese cabbage vary in temperature requirements but all varieties are prone to bolting (going to seed) when expose to low temperature (Dimsey and Barton, 1997).

Temperature

Chinese cabbage thrives best during the cooler periods of the growing season. Although the optimal temperature range of Chinese cabbage development is between 13 and 15 °C, certain cultivars tolerate the higher temperatures of midseason providing there is ample soil moisture (Shattuck and Shelp, 1986).

Soil Type

Chinese cabbage is grown on a wide range of soil types from sandy soils to heavy textured looms. However it prefers deep, rich, well-drained soils and high in organic matter soil. Drainage is important because Chinese cabbage is susceptible to root rots and raised beds should be used particularly on heavier soil type. On lighter soils irrigation management is critical due to their shallow root system and the need to avoid moisture stress. Soil pH in the range of 5.5 or if the disease clubroot is a problem, a pH of around 7.0 is more desirable (Demsey and Barton, 1997).

Fertility

Nitrogen, phosphorus and potassium can either be broadcast or be incorporated, or side-banded. A general recommendation would be 60 to 100 kg/ ha (54 to 89 lbs/ac) of

nitrogen, 150 to 180 kg/ha (133 to 160 lbs/ac) of phosphorus and 170 to 200 kg/ha (152 to 178 lbs/ac) of potassium. Reduce the phosphorus recommendation to $^{1}/_{5}$ if side banded and potassium to ½ if side banded. Nutrient deficient cabbage crops exhibit obvious symptom of the stress except for slow growth. Excessive nitrogen application should be avoided because it can lead to splitting of the head. Calcium and boron are important nutrients. Additional boron may need to be added to avoid decay and hollowing of the pith (core) and calcium may be needed to avoid tip burn (Anonymous, 2005).

Maturity/Heading

Based on head compactness, a compact head can be only slightly compressed with moderate hand pressure. While a very loose head is immature, and a very firm head is mature. The head weight of heading Chinese cabbage is closely correlated with the total number of differentiated leaves, the development of which is about three times more rapid than in non-heading Chinese cabbage. Wrapper leaves supply carbohydrates to the head and induce head formation posture just before the onset of heading and maintains it during the course of head development. Erect leaf posture, the leaf shape and the leaf area large enough to adopt an enclosing configuration are all necessary for head formation. Leaf movement during head formation is controlled by terminal bud, hormone balance and ratio of carbohydrate to nitrogenous compounds. After the establishment of head formation posture different cultivars develop head which fall into one of the three types: cup, bottle or ball (Anonymous, 1981).

Types

Larkcom (2004) noted that the sturdy compact 'barrel-headed' type display a leaves with striking network of prominent white veins radiating from a thick, succulent midrib. Taller, looser-heady cylindrical type is an elegant plant. Both look impressive grown in groups. Easier to grow and giving a softer, light colored impression are the loosed headed types. There is an enormous range within this group, but among the pretties are the so-called 'fluffy top' types. Here the plant forms an upright rosette of crinkled leaves, the outer leaves are light green but the inner leaves are a lovely buttery-cream. Hence, one of the old Chinese names 'Yellow cabbage'.

Varieties

As seedling crops they have a fluffier look than most pak chois, but they grow off their creamy centers appearing as large plants in bold groups. The variety 'Ruffles' is fairly bolt resistant and can be sown in late spring for a mid summer crop. The words 'Shantung' and 'Santo' in oriental varieties indicate the loose headed types (Larkcom, 2004).

Dimsey and Barton (1997) stated that the Michihili (rocket) is elongated in shape, and Wong Bok is short and ovate. Both are grown for export and domestic market. Rocket types are susceptible to bolting than Wong Bok.

Borja (1985) stated that the Danish variety (Granat) has the most superior performance of the Chinese cabbage following the AVRDC cultural practice.

MATERIALS AND METHODS

The materials used were seeds of different varieties of Chinese cabbage, processed chicken manure, 14-14-14, 46-0-0, pesticides, knapsack sprayer, weighing scale, and farm tools.

Experimental Design and Treatments

The experiment was laid out in Randomized Complete Block Design (RCBD) with four replications. The treatments were as follows;

Code	Cultivar	Source/Distributor
V_1	Green Cool	Takii & Co. LTD.
V_2	Taibyo Nozomi	Kaneko seeds Co. Ltd.
V_3	Vigor 60	Takii & Co. Ltd.
V_4	CR-Jinshim F_1	S&G Syngenta Seeds Ltd.
V_5	CR-Nongsaim F_1	S&G Syngenta Seeds Ltd.
V_6	Summer Star F_1	S&G Syngenta Seeds Ltd.
V_7	Blues F_1	Takii & Co. Ltd.

Land Preparation and Planting

An area of 140 sq. m. was thoroughly prepared having 1m x 5m treatments plots. Seeds were sown at a distance of 30 cm x 30 cm. After seedling establishment, thinning was done to retain one plant per hill.

Cultural Management

The recommended cultural practices in Chinese cabbage production in fertilizer application, irrigation, cultivation, and pest control were uniformly imposed to all treatment plants.

Data Gathered

The data gathered and subjected to variance of analysis and mean separation test by Duncan's multiple range test (DMRT) were as follows:

1. Days to heading. The number of days from sowing to 50 % of the plants has formed heads.

2. Percentage of heading. The number of plants that successfully formed heads was recorded and percentage was computed using the formula:

$$\text{Percentage of heading} = \frac{\text{Number of Plants that Formed heads}}{\text{Number of Plants per Plot}} \times 100\%$$

3. Equatorial diameter of heads (cm). This was measured at the mid-section of sample heads.

4. Polar diameter of heads (cm). This was measured from the base to the tip of sample heads.

5. Average weight of head (kg). This was obtained using the formula:

$$\text{Average weight} = \frac{\text{Total Yield per Plot (kg)}}{\text{Number of Harvested Heads per Plot}}$$

6. Marketable yield per plot (kg). This was the weight of all heads without defects which could be sold in the market.

7. Non-marketable yield per plot (kg). This was the weight of heads with defects which could not be sold in the market.

8. Total yield (kg). This was the weight of marketable and non-marketable heads.

9. Computed marketable yield (t/ha). The marketable yield per plot was multiplied by 2,000 to obtain the yield per hectare.

10. Compactness rating. Compactness was rated subjectively using the rating guide below.

Scale	Description
1	No Head Formation
2	Loose
3	Slightly Compact
4	Compact
5	Very Compact

11. Other observations. All the entries were observed for other characteristics such as color and shape of heads. Photos were taken for observations that cannot be quantified.

12. Shelf-life. Sample heads per treatment were taken just after harvesting for post-harvest evaluation. The number of days from display to the day the heads were still fit for consumption was recorded.

RESULTS AND DISCUSSION

Days to Heading and Percentage Heading

Among the varieties, CR-Jinshim F_1, CR-Nongsaim F_1, and Blues F_1 significantly were the earliest to form heads at 77 days from sowing the seed, while Green Cool, Taibyo Nozomi, Vigor 60 and Summer Star F_1 required more days to form heads at 87 days (Table 1)

In Table 1, Blues F_1, Summer Star F_1, Green Cool and CR-Nongsaim F_1 had significantly higher percentage of heading ranging from 89 to 94.

Table 1. Days to heading and percentage heading

VARIETY	MEAN	
	DAYS TO HEADING	PERCENTAGE HEADING
Green cool	87.00a	89.321abc
Taibyo Nozomi	87.00a	84.107c
Vigor 60	87.00a	85.084c
CR-Jinshim F_1	76.75b	86.607bc
CR-Nongsaim	77.00b	88.643abc
Summer Star F_1	87.00a	92.857ab
Blues F_1	77.00b	93.750a

Means followed by a common letter are not significantly different at 0.05 by DMRT

Head Size and Average Head Weight

The widest equatorial diameter of heads measured from Summer Star F_1 was comparable to that of Green Cool and Taibyo Nozomi but were significantly wider than those of the other cultivars as shown in Table 2.

On the other hand, polar diameter of heads did not differ among the varieties evaluated (Table 2).

Blues F_1 developed significantly heavier heads at an average of 1.088g. (Table 2).

Table 2. Equatorial and polar diameter of heads and average head weight

VARIETY	MEAN		
	EQUATORIAL (cm)	POLAR DIAMETER (cm)	AVERAGE HEAD WEIGHT (g)
Green Cool	10.175ab	28.932a	0.873b
Taibyo Nozomi	9.400ab	26.432a	0.705c
Vigor 60	8.232c	28.600a	0.768c
CR-Jinshim F_1	6.275d	25.832a	0.853b
CR-Nongsaim F_1	6.500d	24.500a	0.740c
Summer Star F_1	10.700a	25.668a	0.735c
Blues F_1	7.832c	28.582a	1.088a

Means followed by a common letter are not significantly different at 0.05 by DMRT

Marketable, Non-marketable, Total, and Computed Marketable Yield

Table 3 shows that marketable yield was significantly greater in Blues F_1 at 30.487 kg per 1x5m plot.

There were no significant differences among the varieties with regards to non-marketable yield as shown in Table 3.

Total yield was significantly higher in Blues F_1 at 30.612 kg per 1x 5m plot.

Among the varieties evaluated, Blues F_1 had significantly the highest computed yield at 60.975 t/ ha having the heaviest average head weight.

Table 3. Marketable, non-marketable, total, and computed marketable yield

VARIETY	YIELD (Kg/5 m^2 plot)			COMPUTED MARKETABLE YIELD (t/ha)
	MARKETABLE	NON-MARKETABLE	TOTAL YIELD	
Green Cool	24.407b	0.150a	24.557b	48.815a
Taibyo Nozomi	19.675c	0.375a	20.050c	39.353c
Vigor 60	21.525c	0.250a	21.775c	43.050c
CR-Jinshim F_1	23.925b	0.788a	24.713b	47.850b
CR-Nongsaim F_1	20.750c	0.750a	20.825c	41.500c
Summer Star F_1	20.625c	0.500a	21.125c	41.250c
Blues F_1	30.487a	1.250a	31.737a	60.975a

Means followed by a common letter are not significantly different at 0.05 by DMRT

Head Weight as to Compactness

Among the varieties tested, there were no significant differences on the weight of heads that did not form heads, weight of heads with loose and compact heads, while Taibyo Nozomi, Vigor 60 and CR-Nongsaim F_1 had significantly higher weights of slightly compact heads. Very compact heads were significantly greater in Summer Star F_1 and Blues F_1 as shown in Table 4.

Table 4. Weight of heads according to compactness

VARIETY	MEAN (kg)				
	NO HEAD FORMED	LOOSE	SLIGHTLY COMPACT	COMPACT	VERY COMPACT
Green Cool	0.75a	0.75a	1.00c	6.00a	19.00b
Taibyo Nozomi	0.00a	0.00a	3.25a	5.75a	18.00c
Vigor 60	0.50a	0.75a	3.25a	5.75a	18.00c
CR-Jinshim F_1	0.00a	1.25a	1.00c	7.00a	17.25c
CR-Nongsaim F_1	0.50a	1.00a	3.00ab	6.50a	18.25c
Summer Star F_1	0.00a	0.00a	1.25bc	4.25a	21.75a
Blues F_1	0.00a	0.75a	0.25c	5.25a	21.00ab

Means followed by a common letter are not significantly different at 0.05 by DMRT

Other Observations

Varieties Green Cool, CR- Jinshim F_1 and CR-Nongsaim F_1 were dark green in color, had medium head size and elongated heads. On the other hand, varieties Vigor 60, Summer Star F_1, and Taibyo Nozomi had greenish color and large size heads. Furthermore, Vigor 60 was the tallest while Blues F_1 had the biggest head size and light green in color.

Shelf-life

Shelf life was longest in Blues F_1 and CR-Jinshim F_1 at 40 days while Green Cool and Summer Star F_1 had the shortest shelf-life at 17 days under room condition at an average temperature of 13° C as shown in Table 5.

Table 5. Shelf–life

VARIETY	MEAN (Days)
Green Cool	17
Taibyo Nozomi	25
Vigor 60	25
CR-Jinshim F_1	40
CR-Nongsaim F_1	36
Summer Star F_1	17
Blues F_1	40

Means followed by a common letter are not significantly different at 0.05 by DMRT

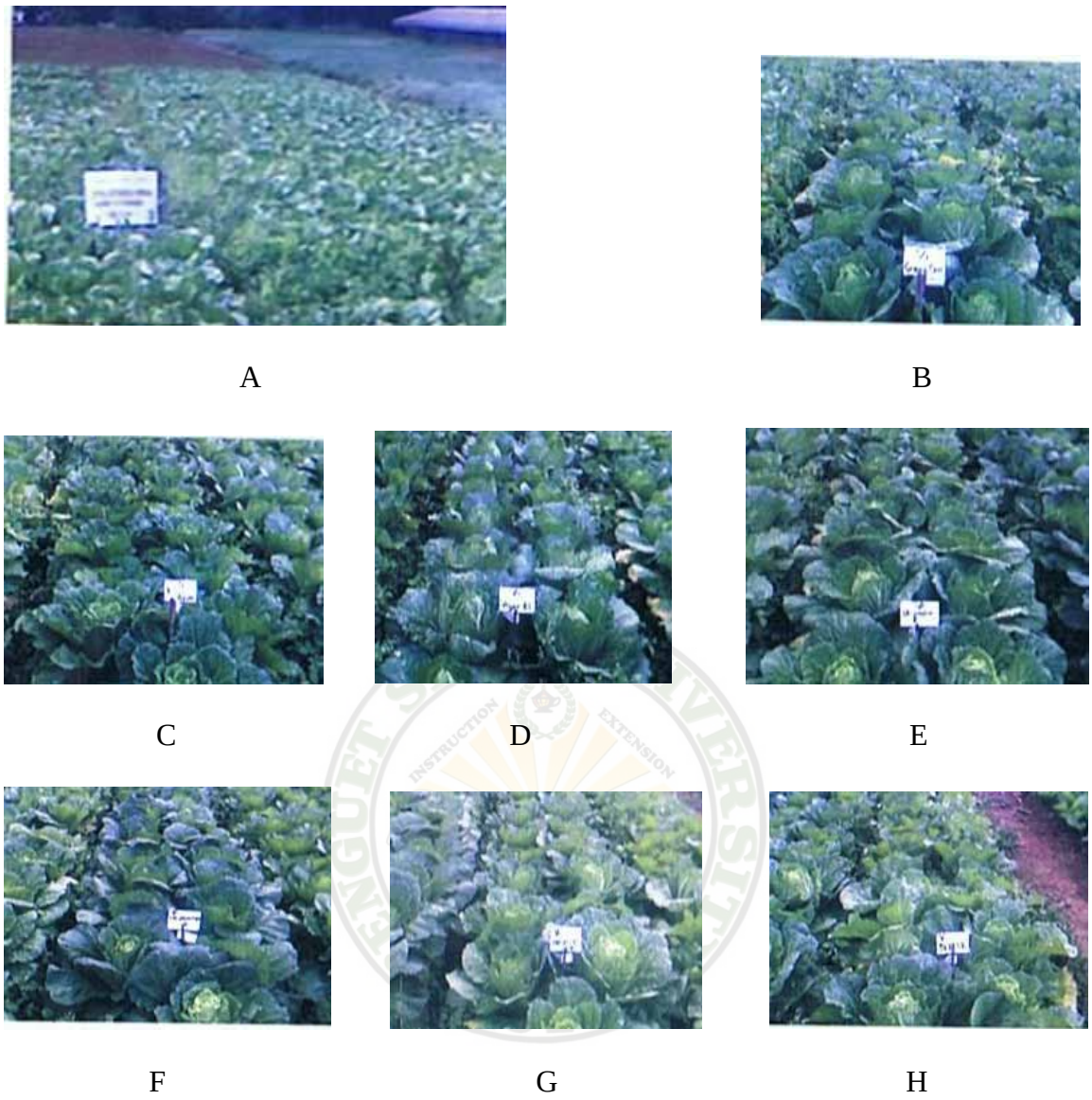
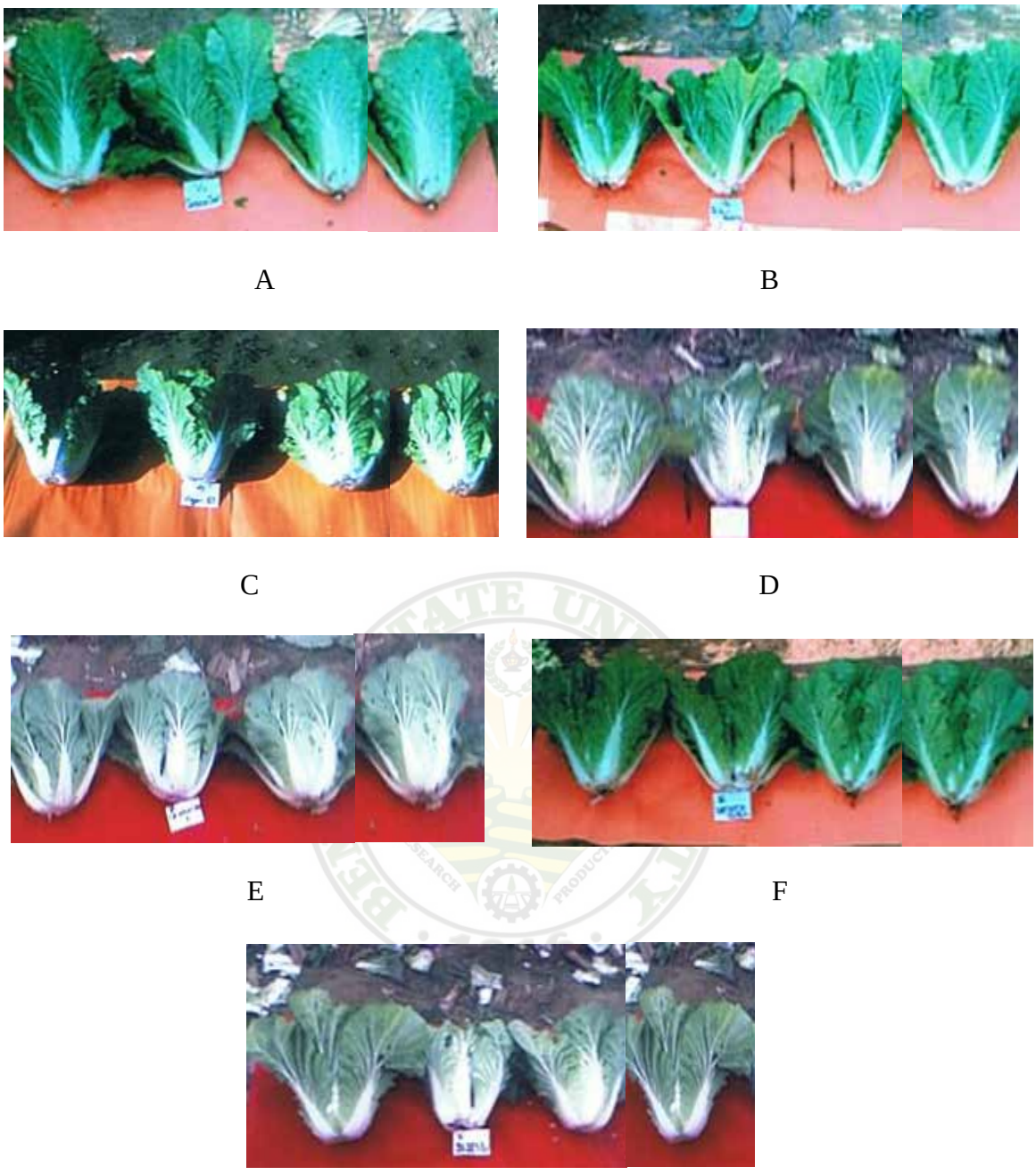


Figure 1. Sample treatment plants: (A) Over view of the experimental field, (B) Green Cool, (C) Taibyo Nozomi, (D) Vigor 60, (E) CR-Jinshim F_1, (F) CR-Nongsaim F_1, (G) Summer Star F_1 and (H) Blues F_1



A B C D E F G

Figure 2. Harvested heads: (A) Green Cool, (B) Taibyo Nozomi, (C) Vigor 60, (D) CR-Jinshim F_1, (E) CR-Nongsaim F_1, (F) Summer Star F_1, and (G) Blues F_1

A

B

C

D

E

F

G

Figure 3. Equatorial diameter of heads (A) Green Cool, (B) Taibyo Nozomi, (C) Vigor 60, (D) CR-Jinshim F_1, (E) CR-Nongsaim F_1, (F) Summer Star F_1 and (G) Blues F_1

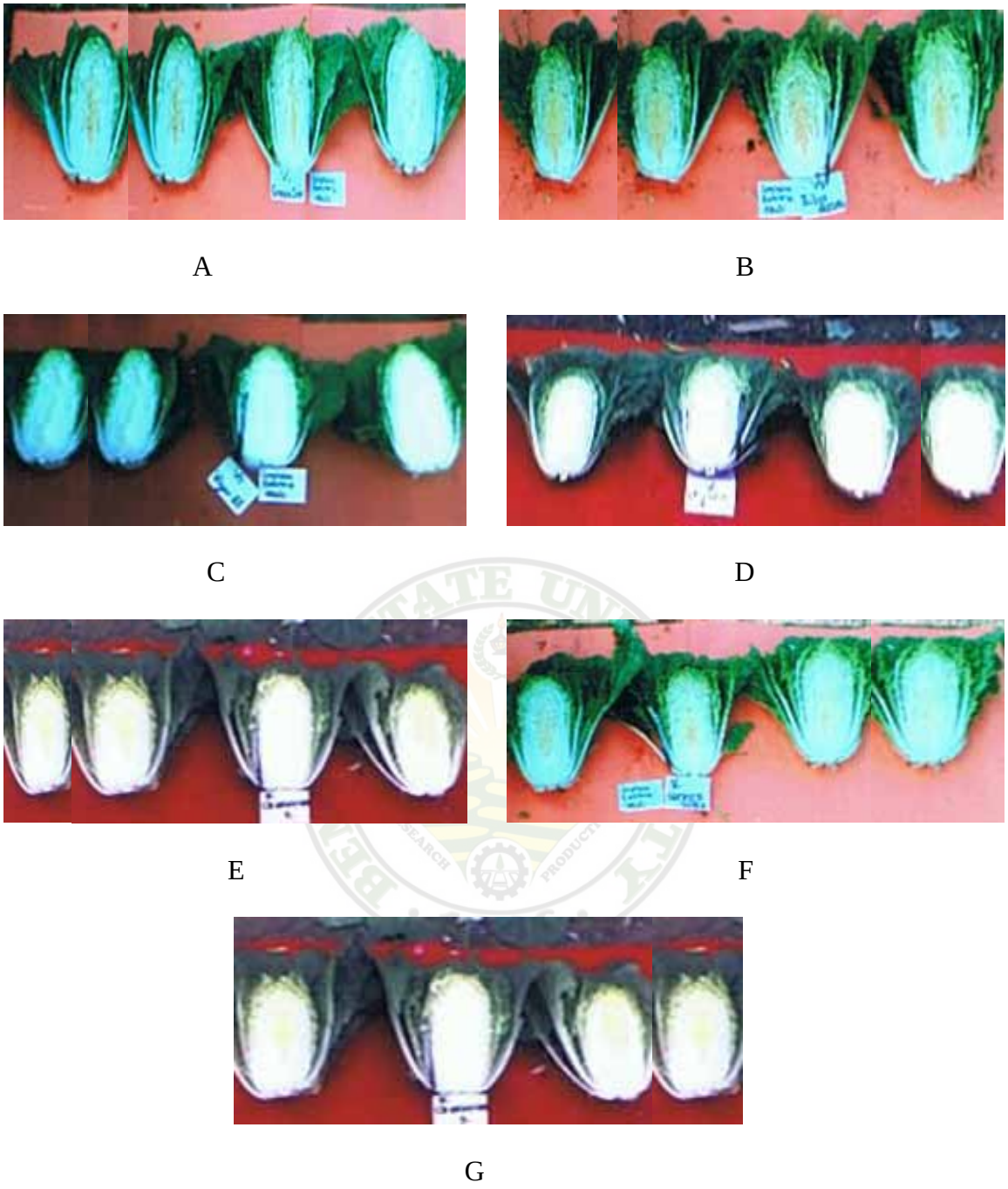


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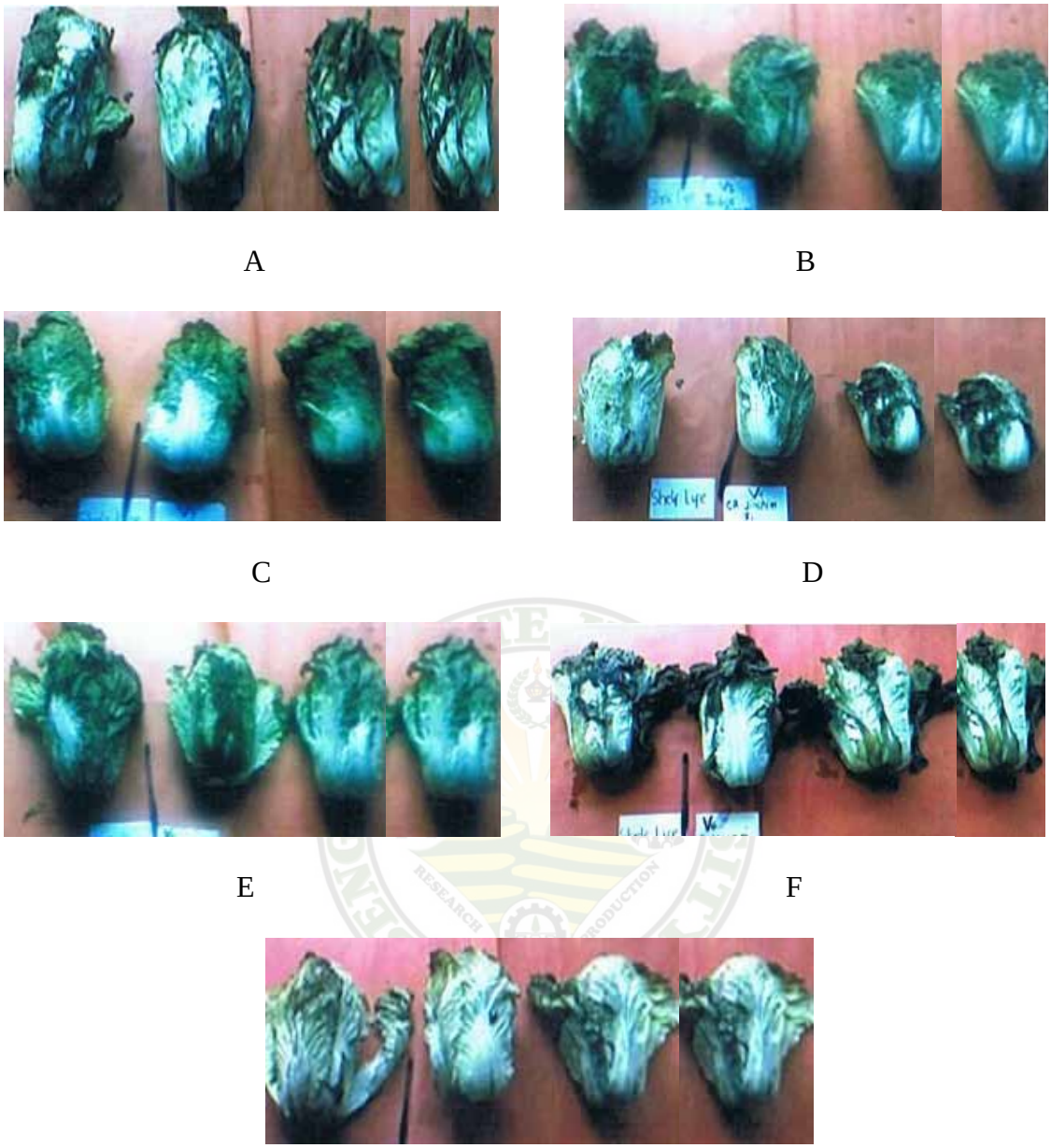
Figure 4. Polar diameter of heads: (A) Green Cool, (B) Taibyo Nozomi, (C) Vigor 60, (D) CR-Jinshim F_1, (E) CR-Nongsaim F_1, (F) Summer Star F_1 and (G) Blues F_1



A B C D E F G

Figure 5. Shelf-life: (A) Green Cool, (B) Taibyo Nozomi, (C) Vigor 60, (D) CR-Jinshim F_1, (E) CR-Nongsaim F_1, (F) Summer Star F_1 and (G) Blues F_1

SUMMARY, CONCLUSION AND RECOMMENDATION

The study was conducted to evaluate the yield performance of seven (7) Chinese cabbage cultivars under La Trinidad, Benguet condition from October to January 2008.

Results show that Blues F_1, Summer Star F_1, CR-Nongsaim F_1, and Green Cool had significantly the highest percentage of heading. In terms of head size, Summer Star F_1 significantly had the widest equatorial diameter.

Average head weight, marketable, total, and computed marketable yield at 60.975 t/ha were significantly higher in Blues F_1. Moreover, the said variety had very compact heads and longer shelf-life of 40 days under room condition with an average temperature of 13° C.

Conclusion

Based on the results, Blues F_1 outyielded the other varieties. Aside from having high yield, it has very compact heads and longer shelf-life.

Recommendation

In terms of having high yield and large heads, Chinese cabbage 'Blues F_1' is recommended to be grown under La Trinidad, Benguet condition.

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APPENDICES

APPENDIX TABLE 1. Days to heading

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	87	87	87	87	348	87.00
Taibyo Nozomi	87	87	87	87	348	87.00
Vigor 60	87	87	87	87	348	87.00
CR-Jinshim F_1	76	77	77	77	307	76.75
CR-Nongsaim F_1	77	77	77	77	308	77.00
Summer Star F_1	87	87	87	87	348	87.00
Blues F_1	77	77	77	77	308	77.00

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	0.107	0.036			
Factor a	6	697.357	116.226	3254.33**	2.66	0.04
Error	18	0.643	0.036			
TOTAL	27	698.107				

** = Significant

Coefficient of variation = 4.89%

APPENDIX TABLE 2. Percentage heading

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	89.286	89.286	92.857	92.857	364.286	91.072
Taibyo Nozomi	92.857	85.714	82.143	85.714	346.428	86.607
Vigor 60	85.714	85.714	82.143	85.714	339.285	84.821
CR-Jinshim F_1	85.714	92.857	89.286	78.571	346.428	88.393
CR-Nongsaim F_1	85.714	89.286	92.857	85.714	353.571	88.393
Summer Star F_1	96.429	85.714	100	89.286	371.429	92.857
Blues F_1	96.429	92.857	92.857	92.857	375	93.750

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	44.684	14.895			
Factor a	6	326.751	54.459	2.89*	2.66	4.01
Error	18	338.678	18.815			
TOTAL	27					

* = Significant

Coefficient of variation = 4.89%

APPENDIX TABLE 3. Equatorial diameter of heads (cm)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	9.2	10.8	10.4	10.3	40.70	10.13
Taibyo Nozomi	9.7	9.5	9	9.4	37.60	9.40
Vigor 60	8.3	8.4	8	8.23	32.93	8.23
CR-Jinshim F_1	6	6.4	6.5	6.2	25.10	6.20
CR-Nongsaim F_1	6	6.5	7	6.5	26.00	6.50
Summer Star F_1	10.6	11.8	9.7	10.7	42.80	10.70
Blues F_1	7	7.5	9	7.83	31.33	7.83

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	1.255	0.418			
Factor a	6	71.609	11.935	38.82**	2.66	4.01
Error	18	0.307				
TOTAL	27	78.397				

** = Significant

Coefficient of variation = 6.57%

APPENDIX TABLE 4. Polar diameter of heads (cm)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	27	30	29.8	28.93	115.73	28.93
Taibyo Nozomi	25	27	27.3	26.43	105.73	26.43
Vigor 60	28.5	29	28.3	28.6	114.4	28.60
CR-Jinshim F_1	26.5	25.5	25.5	25.83	103.33	25.83
CR-Nongsaim F_1	22.5	26	25	24.5	98	24.50
Summer Star F_1	27.3	24.5	25.2	25.67	102.67	25.67
Blues F_1	27	27	28	32.33	114.33	27.33

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	24.751	8.250			
Factor a	6	73.921	12.320	1.73^{ns}	2.66	4.01
Error	18	128.468	7.137			
TOTAL	27	227.139				

ns = not significant

Coefficient of variation = 9.92 %

APPENDIX TABLE 5. Average weight of heads (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	0.91	0.81	0.94	0.83	3.49	0.87
Taibyo Nozomi	0.61	0.7	0.72	0.79	2.82	0.71
Vigor 60	0.71	0.79	0.85	0.72	3.07	0.77
CR-Jinshim F_1	0.8	0.86	0.89	0.86	3.41	0.85
CR-Nongsaim F_1	0.77	0.73	0.82	0 .64	2.96	0.74
Summer Star F_1	0.79	0.77	0.74	0.64	2.94	0.74
Blues F_1	1.02	1.09	1.14	1.1	4.35	1.09

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	19.474	6.491			
Factor a	6	0.420	0.070	21.29**	2.66	4.01
Error	18	0.059	0.003			
TOTAL	27	0.503				

** = Significant

Coefficient of variation = 6.97%

APPENDIX TABLE 6. Marketable yield per plot (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	25.4	22.73	26.4	23.1	97.63	24.41
Taibyo Nozomi	16.95	19.6	20.15	22	78.7	19.68
Vigor 60	20	22	23.85	20.25	86.1	21.53
CR-Jinshim F_1	22.4	24.2	25	24.1	95.7	23.93
CR-Nongsaim F_1	21.6	20.5	22.9	18	83	20.75
Summer Star F_1	22.3	21.5	20.75	17.95	82.5	20.63
Blues F_1	28.5	30.75	31.9	30.8	121.95	30.49

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	19.474	6.491			
Factor a	6	331.246	55.208	21.57**	2.66	4.01
Error	18	46.061	2.559			
TOTAL	27	1587.009				

** = Significant

Coefficient of variation = 6.94%

APPENDIX TABLE 7. Non-marketable yield per plot (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	0	0	0	0.6	0.6	0.15
Taibyo Nozomi	0	0.9	0.6	0	1.5	0.38
Vigor 60	0	0	1	0	1	0.25
CR-Jinshim F_1	0	0	0	0.3	0.3	0.07
Summer Star F_1	0.7	0	1	0.3	2	0.50
Blues F_1	0	0.5	0	0	0.5	0.13

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	34.555	11.518			
Factor a	6	322.996	53.833	19.28**	2.66	4.01
Error	18	50.266	2.793			
TOTAL	27	407.817				

** = Significant

Coefficient of variation = 7.15%

APPENDIX TABLE 8. Total yield per plot (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	25.4	22.73	26.4	23.7	98.23	24.56
Taibyo Nozomi	16.95	20.05	20.75	22	80.2	20.05
Vigor 60	20	22	24.85	20.25	87.1	21.78
CR-Jinshim F_1	22.4	24.7	27.65	24.1	98.85	24.71
CR-Nongsaim F_1	21.6	20.5	23.2	18	83.3	20.83
Summer Star F_1	23	21.5	21.75	18.25	84.5	21.13
Blues F_1	28.5	31.25	31.9	30.8	122.45	30.61

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	34.555	11.518			
Factor a	6	322.996	53.833	19.28**	2.66	4.01
Error	18	50.266	2.793			
TOTAL	27	407.817				

** = Significant Coefficient of variation = 7.15%

APPENDIX TABLE 9. Computed marketable yield (t/ha)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	50.800	45.460	52.800	46.200	19.5260	48.815
Taibyo Nozomi	33.900	39.200	40.300	44.000	15.7400	39.350
Vigor 60	40.000	44.000	47.700	40.500	17.2200	43.050
CR-Jinshim F_1	44.800	48.400	50.000	48.200	19.1400	47.850
CR-Nongsaim F_1	43.200	41.000	45.800	36.000	16.6000	41.500
Summer Star F_1	44.600	43.000	41.500	35.900	16.5000	41.250
Blues F_1	57.000	61.500	63.800	61.600	24.3900	60.975

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	77.951	25.984			
Factor a	6	1324.847	220.808	21.58**	2.66	4.01
Error	18	184.210	10.234			
TOTAL	27	1587.009				

** = Significant

Coefficient of variation = 6.94%

APPENDIX TABLE 10. No head formation (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	3	0	0	0	3	0.75
Taibyo Nozomi	0	0	0	0	0	0.00
Vigor 60	1	0	1	0	2	0.50
CR-Jinshim F_1	0	0	0	0	0	0.00
CR-Nongsaim F_1	0	0	0	2	2	0.50
Summer Star F_1	0	0	0	0	0	0.00
Blues F_1	0	0	0	0	0	0.00

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	1.250	0.417			
Factor a	6	2.500	0.417	0.79^{ns}	2.66	4.01
Error	18	9.500	0.528			
TOTAL	27	13.250				

^{ns}=Not significant Coefficient of variation = 290.59%

APPENDIX TABLE 11. Loose head formation (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	0	3	0	0	3	0.75
Taibyo Nozomi	0	0	0	0	0	0.00
Vigor 60	0	2	0	1	3	0.75
CR-Jinshim F_1	4	0	3	2	9	2.25
CR-Nongsaim F_1	0	2	0	4	6	1.50
Summer Star F_1	0	0	0	0	0	0.00
Blues F_1	1	2	0	0	3	0.75

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	1.571	0.524			
Factor a	6	5.429	0.905	0.55^{ns}	2.66	4.01
Error	18	29.429	1.635			
TOTAL	27	36.429				

^{ns}= Not significant

Coefficient of variation =198.90%

APPENDIX TABLE 12. Slightly compact head formation (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	0	0	2	2	4	1.00
Taibyo Nozomi	2	4	5	4	15	3.75
Vigor 60	3	2	4	3	12	3.00
CR-Jinshim F_1	0	2	0	4	6	1.50
CR-Nongsaim F_1	4	3	2	2	11	2.75
Summer Star F_1	1	4	0	3	8	2.00
Blues F_1	0	0	2	2	4	1.00

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	9.536	3.179			
Factor a	6	35.429	5.905	4.13**	2.66	4.01
Error	18	25.714				
TOTAL	27	70.679				

** = Significant

Coefficient of variation = 63.14%

APPENDIX TABLE 13. Compact head formation (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	5	6	6	6	24	6.00
Taibyo Nozomi	6	5	7	7	23	5.75
Vigor 60	6	4	6	6	23	5.75
CR-Jinshim F_1	8	8	6	6	28	7.00
CR-Nongsaim F_1	8	5	8	8	26	6.50
Summer Star F_1	5	3	5	5	17	4.25
Blues F_1	6	5	4	4	21	5.25

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	3.857	1.286			
Factor a	6	18.714	3.119	2.33^{ns}	2.66	4.01
Error	18	24.143	1.341			
TOTAL	27	46.714				

^{ns}=Not significant Coefficient of variation = 20.02%

APPENDIX TABLE 14. Very compact head formation (kg)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	20	19	19	18	76	19.00
Taibyo Nozomi	18	19	18	17	72	18.00
Vigor 60	18	20	16	18	72	18.00
CR-Jinshim F_1	16	18	19	16	69	17.25
CR-Nongsaim F_1	16	20	21	16	73	18.25
Summer Star F_1	22	20	25	20	87	21.75
Blues F_1	21	20	21	22	84	21.00

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	12.107	4.036			
Factor a	6	68.714	11.452	4.47**	2.66	4.01
Error	18	46.14	2.563			
TOTAL	27	126.964				

** = Significant Coefficient of variation = 8.417%

APPENDIX TABLE 15. Shelf-life (days)

VARIETY	REPLICATION I	II	III	IV	TOTAL	MEAN
Green Cool	17	17	17	16	67	16.75
Taibyo Nozomi	25	25	25	25	100	25.00
Vigor 60	25	25	25	25	100	25.00
CR-Jinshim F_1	40	40	40	40	160	40.00
CR-Nongsaim F_1	36	36	36	36	144	36.00
Summer Star F_1	17	17	17	17	68	17.00
Blues F_1	40	40	40	40	160	40.00

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARE	MEAN SQUARE	F VALUE	TABULAR F 0.05	0.O4
Replication	3	0.107	0.036			
Factor a	6	2462.214	410.369	11490.33**	3.56	5.09
Error	18	0.643	0.036			
TOTAL	27	2462.964				

** = Significant

Coefficient of variation = 0.66%