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ABSTRACT

The study was conducted to determine the growth and yield performance of different cultivars of cucumber under Kibungan, Benguet condition.

Findings revealed that although growth, flowering, fruit set, and maturity were similar in the test cultivars, widest and longest fruits were harvested from Jaguar (Ramgo) and Poinsett 76 (Ferry Morse) with General Lee, F_1 (Condor) also having long fruits. Cultivar Jaguar (Ramgo), General Lee, F_1 (Ferry Morse), General Lee, F_1 (Condor), and Thalia (Kaneko) had the highest yield at 33.20, 32.27, 32.20 and 26.87 t/ha computed marketable yield, respectively. The highest return on investment (ROI) was obtained from growing General Lee, F_1 (Condor) at 134.80% and General Lee, F_1 (Ferry Morse) at 127.51%. High ROI was also realized from Jaguar (Ramgo) at 108.62%, and from Thalia (Kaneko) at 106.51%.

Said cultivars could be recommended for cultivation in said place to derive high yield and profit.

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INTRODUCTION

Nature of the Study

Kibungan is one of the municipality of Benguet, bounded on the north by the municipality of Bakun and the east by the municipality of Buguias, on the north by the municipalities of Atok and Kapangan and on the west by the province of Ilocos Sur.

Palina is located at the northern most tip of the municipality of Kibungan with a distance of 26 km. away from Halsema National Highway. It is a rugged mountainous terrain and has three types of soil, sand, loam, and clay. These types of soil are suitable to wide variety of agricultural crops. Rice is the suitable crop but it is not for commercial purposes, root crops and upland vegetables are also produced.

Cucumber (*Cucumis sativus L.*) a member of gourd family (Cucurbitacaea), probably a native of Asia and it has been under cultivation for several thousand of years. In 1995, a survey was made in La Trinidad, Benguet and Mountain Province, out of 49 vegetable growers in the locality who planted 28 kinds of vegetables on a total area of 29 hectares, it is the only crop belonging to the cucurbits family planted to any extent.

According to peso value per hectare, chayote, summer squash, and cucumber ranked 3rd, 10th and 16th , respectively of all the vegetable planted. While in USA, during early 1960s the cucumber ranked 9th in total area under cultivation and 12th in cash value among vegetable crops.

At present cucumber is rapidly gaining popularity among processors. The recent establishment of pickles factories provides a good market outlet of this crop.

Proper selection of crops that are adapted in a certain area is one way of increasing food production. Since vegetable varieties perform best in a certain

environment, it follows that to get highest vegetable yields, farmers should choose the climate or environment in which vegetable crops will be grown.

Importance of the Study

Vegetable production is the major source of livelihood of farmer in the Province of Benguet and some parts of the country. However, one main constraint in the vegetable industry is the fact that the vegetable seeds are mostly imported. In addition, different cultivars developed in other countries have different performance when grown in the locality. This makes it important to conduct an evaluation of cultivars.

Objectives of the Study

The study aimed to:

1. Determine the growth and yield performance of different cucumber cultivars under Kibungan, Benguet condition, and
2. Identify the cultivar(s) best adapted under Kibungan, Benguet condition.

Place and Time of the Study

This study was conducted in Palina, Kibungan, Benguet from November 2007 to February 2008.

REVIEW OF LITERATURE

Description Cucumber

According to Erbe (2002) cucumber is a trailing plant cultivated for its long fleshy fruits that is eaten raw as vegetable salad or used for pickling. The cucumber plant is a hairy- stemmed vine that bears many tendrils. The vines spreading with triangular-ovate leaves may have three pointed lobes. The plant bears yellow or whitish flowers on short stems about 2-3 cm. across. Its edible fruits, which is common called cucumber. Furthermore, cucumbers are good low- calorie salad item, they are also good source of iron and calcium and they provide a moderate amount of vitamin (World Book, 1990).

Edmund (1964) further mentioned that cucumber leaves are simple, alternate and angular. The staminate flowers occur in clusters and pistillate flower occurs singly or occasionally in group of two or more. The female flowers may have distinguished from male flowers by the young ovary located in back of petals. Under field condition the male flowers appear one or two weeks before the first female flowers. Since the blossoms and fruits are borne in leaf axis, continuous growth of stems is necessary for high yields. In general, the fruits are elongated and cylindrical they vary from size (long, moderate long, short) color of rind (light to dark green) and color of the spines (white and black).

Importance and Nutritional Value of Cucumber

Knott (1967) mentioned that cucurbits vary greatly in their uses. Although is not exceeding high in food value, these crops play an important role in the Filipinos diet. Nutritionally, most of them are about 90% water, however, some are quite rich source of vitamin A. In addition, table or slicing cucumber are grown for their market in many

regions in the Philippines. Despite their low nutritive value, they are in demand commercially and most families grow some for their own consumption. They add variety to the diet and are pleasant to eat, when made into pickles they are used as appetizers.

In addition, Undan (1983) stated that cucumber is a well known fruit with many uses in a variety of food preparations. Pickled cucumber is universal ingredient in salads, dishes, dips, sauces and some gravy. Fresh cucumber is also used in the preparations of sandwich spread and burgers. Cucumber can be eaten raw or cook and the fruit extracts is used in the preparation of cosmetics and medicines. It can also cure kidney ailments when eaten regularly.

Nutritionally cucumber contains 96.40 % water, 12.0 calorie of food energy, 0.6 gm protein, 0.2 gm fat, 2.4 gm total carbohydrate, 0.5 gm fiber, 0.4 gm ash, 19 mg calcium, 12 mg phosphorous, 122 mg potassium, 0.4 mg iron, 5 mg sodium, 0.02 mg thiamine, 0.02 mg riboflavin, 0.1 mg niacin, 10 mg ascorbic acid (Lorenz and Maynard, 1988).

Soil and Climatic Requirements

Cucumber can be grown on a widely variety of soils. However, maximum production is likely to be obtained on a well-drained, fairly fertile sandy loam soil rich in organic matter. A soil has good water- holding water capacity is desirable especially if rainfall is likely to be limited and irrigation cannot be provided. The optimum monthly average for good growth for most cucurbits is from 18- 24° C and warm temperature and relative low humidity favor good fruit setting possibly due their influence of sac dehiscence and bee activity (Knott, 1967).

Thompson (1959) further pointed that cucumber grown successfully on many kinds of soil from sands to heavy soils. Where earliness is the prime consideration, a sandy soil or sandy loam is preferred, when heavy yields are most important loam and silt or clay loam is preferred. Cucumber plants grow well of a soil reaction between ph of 5.5 – 6.7 provide other factors satisfactory. The soil should be well drained. Knott (1967) added that cucumber do best on slightly acid to neutral soils but will tolerate soil ph of 5.5 to 6.8.

Moreover, Christopher (1958) also mentioned that cucumber will grow over a wide pH range 5.5 to 6.8 and liming is seldom important. The plant is deep rooted and under favorable condition will grow rapidly and developed marketable fruits from 60 to 70 days. In the plants are not tolerant standing water and good drainage is very important.

Cucumber needs lot of water, sprinkling is not recommended for most gardens because it encourages mildew. Furrow irrigation works best but vines can clog the irrigation furrows. Train all the vines in one direction to keep the irrigation open. In a small garden, train the vines up to 3-5 feet high critical and slanted tigers covered with chicken wires or strong stout twine. Cucumber vines don't cling, tie them up every foot or so. Pinch out the tips or a rambling vines. This will cause more branches to form, (Work, 1955). Ware (1980) stated that the most critical need occurs at the fruiting. Moisture stress then seriously reduced the yield of marketable fruit. Furrow is irrigation is preferable where it can be used, however, when over head system is used water should be applied early enough in the day and that the soil and leaves dry before night fall to reduced the spread of fruit rotting and foliage diseases.

Selection of Vegetable Variety

Lorenz and Maynard (1988) stated that selection of the variety is one of the most important decisions in the commercial vegetable grower must make each season. Growers should evaluate new varieties each year on a trial basis to observe performance of their own farms. Considering the yield performance of the variety it should have the potential to provide crops at least equivalent to those already grown. Harvested yield is usually much less than potential yield because of market restraints.

The selection of the variety will minimize the problems associated with water and fertilizer management. On the other hand, growing the wrong variety may mean crop failure because of disease infestation. The genotypes of the variety usually determines the yielding quality, regional adaptability, resistant to disease and pest quality (Bautista, 1986).

A vegetable variety will perform best in a certain environment, it follows that to get highest vegetable yields the farmer should choose the varieties selected for the climate or environment in which his vegetable crop will be grown. Further, when poor varieties are selected, the possibility for high profit is eliminated before the first seed is planted (Villareal, 1969).

Variety Trials and Selecting Variety

Edmund (1964) reported that the varieties and strains differ in productivity. For any region some varieties of the same kind and some strains of the same variety are adaptable and thus profitable and other varieties and strains are non-adaptable and thus relatively unprofitable. In other words, there are marked differences in the behavior of

varieties and of strains with in varieties. Thus, a certain variety or strain may be adaptable to one region of the country and unadaptable to another.

According to Ware (1980) cultivars should be selected which grow vigorously, yield well, resist disease and have desirable market characteristics and selection of cultivars will also depend upon on the use for which the product intended.

A crop of vegetable may be much poor than the seed that is planted but it cannot be better. Soil and water may prevent plants from yielding the amount or quality that their parentage would lead the grower to expect, but soil and water cannot bring out of the plants better quality than is bound up in the capabilities of the plant seed. Therefore, careful selection of seed is one of the most important factors for success in gardening (Work, 1955).

MATERIALS AND METHODS

Materials

The materials used in the study were cucumber seeds of different cultivars, fertilizers such as chicken manure, 14-14-14, trellis, and farm tools.

Methods

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications.

The treatments were as follows:

Code	Cultivar	Company
C1	General Lee, F_1 hybrid (control)	Ferry Morse
C2	Thalia	Kaneko Seeds Corporation
C3	Poinsett	Kaneko Seeds Corporation
C4	Jaguar	Ramgo
C5	Poinsett 76	Ferry Morse
C6	General Lee, F_1 hybrid	Condor
C7	Poinsett 76	Kaneko Seeds Corporation

Land preparation and planting. The area of 105 square meters were thoroughly prepared with plots having dimension of 1m x 5m.

Two seeds were sown per hill at a distance of 40cm x 40cm. One week after emergence, thinning was done to retain one plant per hill.

Cultural Management

The recommended cultural practices in cucumber production in fertilizer application, irrigation, cultivation, and pest control were equally employed to each treatment plot.

Data Gathered

The data gathered and subjected to variance analysis, and mean separation test by Duncan's Multiple Range Test were as follows.

1. Percentage Germination. This was taken one week after sowing the seeds using the formula.

$$\% \text{ Germination} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds sown}} \times 100$$

2. Number of days to first flowering. This was taken when 50 % of the plants developed flowers.
3. Number of days from fruit set to fruit harvest. Sample fruits were tagged and the number of days from fruit set to harvest were counted.
4. Number of days from sowing to first picking. The number of days from sowing to first fruit picking were recorded.
5. Fruit diameter (cm). Six marketable fruits per plot were picked at random and the diameter at the mid- section was measured with the used of vernier caliper.
6. Fruit length (cm). Six marketable fruits per plot were picked at random and measured from the anterior to the stylar end of the fruit with the use of ruler.
7. Weight of marketable fruits per plot (kg). The weight of fruits without defects and are marketable.

8. Weight of non-marketable fruits per plot (kg). The weight of fruits with defects or abnormalities.
9. Total yield (kg). This was the weight of non- marketable and marketable fruits harvested.
10. Computed marketable yield per hectare (t/ ha). The marketable yield per plot were computed to hectare basis by multiplying it with 2,000.
11. Average fruit weight (g). Six sample fruits were weighed and then average weight was taken.
12. Percentage fruit set. This was taken by dividing the number of fruits that set by the number of female flowers times 100.
13. Vine length (cm). This was measured from the base to the tip of the vine.
14. Female –male ratio. It was taken by dividing the number of female flowers by the number of male flowers.
15. Cost and return analysis.

$$\text{ROI} = \frac{\text{Total sales-total expenses}}{\text{Total expenses}} \times 100$$

16. Other observations. Flowering and fruiting characteristics.
17. Documentation in pictures.

RESULTS AND DISCUSSION

The study was conducted to determine the performance of different cucumber cultivars under Kibungan, Benguet condition and to identify the cultivar best adapted under Kibungan, Benguet condition. The results are presented and discussed in this section.

Percentage Germination

The percentage germination is presented in Table1. Result showed that the cultivars of cucumber had no significant differences on percentage germination.

However, the cultivars General Lee, F_1 (Ferry Morse) and General Lee, F_1 (Condor) had the highest percentage germination with a mean of 97.62% and 96.43%, respectively, followed by Thalia (Kaneko), Jaguar (Ramgo) and Pionsett (Kaneko). It appears that cultivars Pionsett 76 (Kaneko) and Poinsett 76 (Ferry Morse) had the lowest percentage germination.

Table 1. Percentage germination

CULTIVAR	MEAN
General Lee, F_1 (Ferry Morse)	97.62 a
Thalia (Kaneko)	90.48 a
Poinsett (Kaneko)	88.10 a
Jaguar (Ramgo)	90.48 a
Poinsett 76 (Ferry Morse)	80.74 a
General Lee, F_1 (Condor)	96.43 a
Poinsett 76 (Kaneko)	80.95 a

Means with a common letter are not significantly different at 5% level by DMRT

Number of Days from Planting to Flowering

The number of days from planting to flowering is shown in Table 2. Statistical analysis showed that there were significant differences among the cultivars. General Lee, F1 (Ferry Morse), Thalia (Kaneko), and General Lee, F_1 (Condor) significantly flowered earlier than the other cultivars.

Table 2. Number of days from planting to flowering

CULTIVAR	MEAN
General Lee, F_1 (Ferry Morse)	39b
Thalia (Kaneko)	39b
Poinsett (Kaneko)	44a
Jaguar (Ramgo)	43a
Poinsett 76 (Ferry Morse)	44a
General Lee, F_1 (Condor)	39b
Poinsett 76 (Kaneko)	44a

Means with a common letter are not significantly different at 5% level by DMRT

Female – Male Flower Ratio

There were no significant differences in female-male flower ratio of the cultivars studied (Table 3).

Table 3. Female – male flower ratio

CULTIVAR	MEAN
General Lee, F_1 (Ferry Morse)	0.87a
Thalia (Kaneko)	0.75a
Poinsett (Kaneko)	0.77a
Jaguar (Ramgo)	0.52a
Poinsett 76 (Ferry Morse)	0.60a
General Lee, F_1 (Condor)	0.80a
Poinsett 76 (Kaneko)	0.75a

Means of a common letter are not significantly different at 5% level by DMRT.

Percentage Fruit Set

The percentage fruit was statistically similar in all the cultivars ranging from 70.00% to 86.67% as shown in Table 4.

Table 4. Percentage fruit set

CULTIVAR	MEAN
General Lee, F_1 (Ferry Morse)	86.67a
Thalia (Kaneko)	76.67a
Poinsett (Kaneko)	80.00a
Jaguar (Ramgo)	76.67a
Poinsett 76 (Ferry Morse)	70.00a
General Lee, F_1 (Condor)	86.67a
Poinsett 76 (Kaneko)	70.00a

Means with a common letter are not significantly different at 5% level by DMRT

Number of Days From Fruit Set to Fruit Harvest

Table 5 shows the days from fruit set to fruit harvest. It was observed that General Lee, F_1 (Ferry Morse), Thalia (Kaneko), and General Lee, F_1 (Condor) significantly had fruits earlier to be harvested from fruit set compared to the other cultivars.

Table 5. Number of days from fruit set to fruit harvest

CULTIVAR	MEAN
General Lee, F_1 (Ferry Morse)	21c
Thalia (Kaneko)	21c
Poinsett (Kaneko)	23b
Jaguar (Ramgo)	25a
Poinsett 76 (Ferry Morse)	23b
General Lee, F_1 (Condor)	21c
Poinsett 76 (Kaneko)	23b

Means with a common letter are not significantly different at 5% level by DMRT

Number of Days From Sowing to First Fruit Harvest

The number of days from sowing to first fruit harvest did not differ significantly among the cultivars evaluated as shown in Table 6. However if took 62 to 70 days to harvest from sowing time.

Table 6. Number of days from sowing to first fruit harvest

CULTIVAR	MEAN
General Lee, F_1 (Ferry Morse)	62a
Thalia (Kaneko)	63a
Poinsett (Kaneko)	68a
Jaguar (Ramgo)	70a
Poinsett 76 (Ferry Morse)	70a
General Lee, F_1 (Condor)	62a
Poinsett 76 (Kaneko)	68a

Means with a common letter are not significantly different at 5% level by DMRT

Vine Length

Vine length is presented in Table 7. There were no significant differences in vine length among the cultivars.

Table 7. Vine length

CULTIVAR	MEAN (cm)
General Lee, F_1 (Condor)	129.00a
Thalia (Kaneko)	118.45a
Poinsett (Kaneko)	119.78a
Jaguar (Ramgo)	121.67a
Poinsett 76 (Ferry Morse)	113.13a
General Lee, F_1 (Condor)	125.34a
Poinsett 76 (Kaneko)	104.33a

Means with a common letter are not significantly different at 5% level by DMRT

Fruit Diameter and Length

Significantly wider fruits areas taken from cultivar Jaguar (Ramgo) and Poinsett 76 (Ferry Morse) at 4.08 and 3.96 cm, respectively. On the other hand, Jaguar (Ramgo), Poinsett 76 (Ferry Morse) and General Lee, F_1 (Condor) produced significantly the longest fruits at 20.24, 19.56 and 19.06, in that order (Table 8).

Table 8. Fruit diameter and length

CULTIVAR	MEAN	
	FRUIT DIAMETER (cm)	FRUIT LENGTH (cm)
General Lee, F_1 (Ferry Morse)	3.52b	18.96bc
Thalia (Kaneko)	3.03c	16.77d
Poinsett (Kaneko)	3.32b	17.93cd
Jaguar (Ramgo)	4.08a	20.24a
Poinsett 76 (Ferry Morse)	3.96a	19.58ab
General Lee, F_1 (Condor)	3.41b	19.06abc
Poinsett 76 (Kaneko)	3.46b	17.71d

Means with common letter are not significantly different at 5% level by DMRT

Average Fruit Weight

Table 9 shows significant differences on the average weight per fruit. All the cultivars, except Poinsett (Kaneko) and Poinsett 76 (Kaneko) which had short fruits, had heavier fruits ranging from 287.00 to 358.57 g.

Table 9. Average fruit weight

CULTIVAR	MEAN (g)
General Lee, F_1 (Ferry Morse)	296.28ab
Thalia (Kaneko)	287.00ab
Poinsett (Kaneko)	210.28c
Jaguar (Ramgo)	358.57a
Poinsett 76 (Ferry Morse)	343.89a
General Lee, F_1 (Condor)	295.18ab
Poinsett 76 (Kaneko)	225.61bc

Means with common letter are not significantly different at 5% level by DMRT

Marketable, Non-marketable, Total, Computed Marketable Yield

Table 10 shows that marketable, total, and computed marketable yield were highest in cultivar Jaguar (Ramgo) which were comparable to the yield of cultivars General Lee, F_1, (Ferry Morse), General Lee, F_1 (Condor), and Thalia (Kaneko) but significantly higher than the yield of the other cultivars. The fruits of Jaguar (Ramgo) are bigger and longer which resulted to a high marketable yield of 33.20 t/ha.

On the other hand, there were no significant differences noted on the non-marketable yield (Table 10). Lowest weight of non-marketable fruits was, however, taken from cultivars General Lee, F_1 (Ferry Morse) and General Lee, F_1 (Condor).

Table 10. Marketable, Non-marketable, total and computed marketable yield

CULTIVAR	YIELD			
	MARKETABLE ($kg/5m^2$ plot)	NON-MARKETABLE ($kg/5m^2$ plot)	TOTAL ($kg/5m^2$ plot)	COMPUTED MARKETABLE (t/ha)
General Lee, F_1 (Ferry Morse)	16.13ab	1.40a	17.53ab	32.27ab
Thalia (Kaneko)	13.43abc	1.83a	15.28bc	26.87abc
Poinsett (Kaneko)	12.83bc	1.83a	14.67bc	25.67bc
Jaguar (Ramgo)	16.57a	2.50a	19.13a	33.20a
Poinsett 76 (Ferry Morse)	10.63c	2.33a	12.97c	21.27c
General Lee, F_1 (Condor)	16.10ab	1.50a	17.60ab	32.20ab
Poinsett 76 (Kaneko)	12.10c	1.87a	13.97c	24.20c

Means with a common letter are not significantly different at 5% level by DMRT

Cost and Return Analysis

Table 11 shows that cultivar General Lee F_1 (Condor) gave the highest return on investment of 134.80% or Php 1.35 for every peso invested in production, followed by General Lee F_1 (Ferry Morse), Jaguar (Ramgo), Thalia (Kaneko), Poinsett (Kaneko), Poinsett 76 (Kaneko), and Poinsett 76 (Ferry Morse) at 127.51, 108.62, 106.51, 82.36 and 41.39%, respectively.

Selling price of cucumber cultivars was based on the size and skin appearance. Prevailing price during the harvest were: Php 18.00-22.00 per kilogram for the

first class classification (long fruits and good skin appearance) and Php 8.00 per kilogram for the second class classification (smaller fruits and deformed shape and poor skin appearance).

Table 11. Cost and return analysis

ITEM	CULTIVARS						
	GENERAL LEE, F_1 (Ferry Morse)	THALIA (Kaneko)	POINSETT (Kaneko)	JAGUAR (Ramgo)	POINSETT 76 (Ferry Morse)	GENERAL LEE, F_1 (Condor)	POINSETT 76 (Kaneko)
Yield (kg/15 m^2)	48.40	40.30	38.50	49.72	31.90	48.30	36.30
Sales (Php)	959.80	788.60	749.00	775.20	325.00	943.60	714.60
Farm inputs (Php)							
Seeds	100.00	60.00	70.00	50.00	50.00	80.00	70.00
14-14-14	32.14	32.14	32.14	32.14	32.14	32.14	32.14
Chicken dung	60.00	60.00	60.00	60.00	60.00	60.00	60.00
Curzate	60.00	60.00	60.00	60.00	60.00	60.00	60.00
Acine	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Labor (Php)							`
Land Preparation	21.43	21.43	21.43	21.43	21.43	21.43	21.43
Planting	2.67	2.67	2.67	2.67	2.67	2.67	2.67
Seeds Irrigation	5.35	5.35	5.35	5.35	5.35	5.35	5.35
Spraying	2.67	2.67	2.67	2.67	2.67	2.67	2.67
Hilling-up/threshing	5.36	5.36	5.36	5.36	5.36	5.36	5.36
Harvesting	9.38	9.38	9.38	9.38	9.38	9.38	9.38
Transportation	82.86	82.86	82.86	82.86	82.86	82.86	82.86
TOTAL EXPENSES (Php)	421.87	381.87	391.87	371.87	371.87	371.87	391.87
NET INCOME (Php)	537.93	406.73	357.13	403.33	152.93	541.73	322.73
ROI (%)	127.51	106.51	91.13	108.62	41.39	134.80	82.36
Rank	2	4	5	3	7	1	6

Other Observations

All the cultivar entries had dark green fruits and white spines. However, General Lee, F_1 (Condor) cultivar have more spines. Male and female flowers were found in every leaf axis, where male flowers occur singly or in clusters while female flowers occurs singly.

More lateral shoots were observed from General Lee, $F_{1.}$ (Ferry Morse)

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Pictorial Presentation

Plate 1. Overview of the experiment field

Plate 2. Cultivar treatment plants - Poinsett (Kaneko)

Poinsett 76 (Kaneko)

General Lee, F1 (Ferry Morse)

Cultivar Thalia (Kaneko)

Poinsett 76 (Ferry Morse)

General Lee, F1 (Condor)

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study was conducted in Palina, Kibungan, Benguet from November 2007 to February 2008 to determine the growth and yield performance of different cultivars of cucumber and to identify the cultivar best adapted in the place.

Findings showed that there were no significant differences in percentage germination, female to male flower ratio, percentage fruit set, number of days from sowing to harvesting, vine length, and non- marketable yield.

Cultivar Jaguar (Ramgo) and Poinsett 76 (Ferry Morse) had the widest and longest fruits. General Lee, F_1 (Condor) also produced long fruits. Marketable and total yield were highest in cultivar Jaguar (Ramgo), General Lee, F_1 (Ferry Morse), General Lee, F_1 (Condor), and Thalia (Kaneko) with computed marketable yield of 33.20, 32.27, 32.20, and 26.87 t/ha, respectively.

The highest return on investment was realized from cultivar General Lee, F_1 (Condor) at 134.80% followed by 127.51, 108.62, and 106.51 from General Lee F1, (Ferry Morse), Jaguar (Ramgo), and Thalia (Kaneko), in that order.

Conclusion

Based on the results, the cultivars best grown under Palina, Kibungan, Benguet condition in terms of high yield and ROI obtained are Jaguar (Ramgo), General Lee, F_1 (Ferry Morse), General Lee, F_1 (Condor), and Thalia (Kaneko).

Recommendation

It is therefore recommended that General Lee, F_1 (Condor), General Lee, F_1 (Ferry Morse), Jaguar (Ramgo), and Thalia (Kaneko) be grown in Kibungan, Benguet for better crop performance and income realized. Cultivar evaluation may be also done in other places.

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APPENDICES

Appendix Table 1. Percentage germination

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	100	92.86	100	292.86	97.620
Thalia (Kaneko)	89.29	89.29	85.71	271.43	90.477
Poinsett (Kaneko)	89.29	89.29	85.71	264.29	88.097
Jaguar (Ramgo)	100	92.86	78.57	271.43	90.477
Poinsett 76 (Ferry Morse)	39.26	67.86	85.71	242.23	80.143
General Lee, F_1 (Condor)	92.86	100	96.43	289.29	96.430
Poinsett 76 (Kaneko)	71.43	82.29	82.14	242.86	80.953

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	72.396	36.198			
Factor A	6	801.440	133.573	1.80 ^{ns}	3.00	4.82
Error	12	891.094	74.258			
TOTAL	20	1764.930				

ns = not significant Coefficient of Variation: 9.65%

Appendix Table 2. Number of days from planting to flowering

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	40	38	40	118.0	39.333
Thalia (Kaneko)	40	40	38	118.0	39.333
Poinsett (Kaneko)	45	45	42	132.0	44.000
Jaguar (Ramgo)	42	42	45	129.0	43.000
Poinsett 76 (Ferry Morse)	45	45	42	132.0	44.000
General Lee, F_1 (Condor)	40	40	38	118.0	39.333
Poinsett 76 (Kaneko)	42	45	45	132.0	44.000

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	2.000	1.000			
Factor A	6	102.571	17.095	6.48 **	3.00	4.82
Error	12	30.000	2.500			
TOTAL	20	134.571				

** = highly significant Coefficient of Variation: 9.65%

Appendix Table 3. Female and male flower ratio

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	13	13.67	13.33	40.00	13.333
Thalia (Kaneko)	12.33	13.33	11	36.66	12.220
Poinsett (Kaneko)	13.67	13.33	14	41.00	13.667
Jaguar (Ramgo)	12.67	14.67	10.67	38.01	12.670
Poinsett 76 (Ferry Morse)	12.67	12.33	12.33	37.33	12.443
General Lee, F_1 (Condor)	14.67	14.67	18.33	47.67	15.890
Poinsett 76 (Kaneko)	13.67	18.33	11.67	43.67	14.557

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	6.731	3.365			
Factor A	6	30.951	5.158	1.68 ^{ns}	3.00	4.82
Error	12	36.815	3.068			
TOTAL	20	74.497				

ns = not significant Coefficient of Variation: 12.94%

Appendix Table 4. Percentage fruit set

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	90	80	90	260.0	86.667
Thalia (Kaneko)	80	70	90	240.0	80.000
Poinsett (Kaneko)	70	80	80	230.0	76.667
Jaguar (Ramgo)	70	80	80	230.0	76.667
Poinsett 76 (Ferry Morse)	60	80	70	210.0	70.000
General Lee, F_1 (Condor)	90	90	80	260.0	86.667
Poinsett 76 (Kaneko)	60	80	70	210.0	70.000

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	157.381	76.190			
Factor A	6	857.143	142.857	2.40 ^{ns}	3.00	4.82
Error	12	714.286	59.524			
TOTAL	20	1723.810				

ns = not significant Coefficient of Variation: 9.88%

Appendix Table 5. Number of days from fruit set to harvest

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	20.9	20.9	20.6	62.40	20.800
Thalia (Kaneko)	21.2	20.9	21.2	63.30	21.100
Poinsett (Kaneko)	23.1	23.0	23.0	69.10	23.033
Jaguar (Ramgo)	24.8	24.6	24.6	74.00	24.667
Poinsett 76 (Ferry Morse)	22.8	23.9	23.5	70.20	23.400
General Lee, F_1 (Condor)	20.8	21.2	20.6	62.60	20.867
Poinsett 76 (Kaneko)	22.7	23.1	23.3	69.10	23.033

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	0.123	0.064			
Factor A	6	40.619	6.770	79.35**	3.00	4.82
Error	12	1.024	0.085			
TOTAL	20	41.766				

** = highly significant Coefficient of Variation: 1.30%

Appendix Table 6. Number of days to first picking

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	66	62	57	185.0	61.667
Thalia (Kaneko)	62	66	62	190.0	63.333
Poinsett (Kaneko)	66	72	66	204.0	68.000
Jaguar (Ramgo)	72	66	72	210.0	70.000
Poinsett 76 (Ferry Morse)	66	72	72	210.0	70.000
General Lee, F_1 (Condor)	62	57	66	185.0	61.667
Poinsett 76 (Kaneko)	72	66	66	204.0	68.000

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	2.381	1.190			
Factor A	6	253.810	42.302	2.73 ^{ns}	3.00	4.82
Error	12	185.619	15.468			
TOTAL	20	441.810				

ns = not significant Coefficient of Variation: 5.95%

Appendix Table 7. Vine length (cm)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	119	143	125	387.00	129.000
Thalia (Kaneko)	122.67	114.67	118	355.34	118.447
Poinsett (Kaneko)	115.67	117.67	126	359.34	119.780
Jaguar (Ramgo)	128.67	125.	111.33	365.00	121.667
Poinsett 76 (Ferry Morse)	123.33	98	118	339.39	113.130
General Lee, F_1 (Condor)	114.67	111.67	149.67	376.01	125.337
Poinsett 76 (Kaneko)	109.33	97.67	106	313.00	104.333

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	153.877	76.939			
Factor A	6	1192.509	198.752	1.37 ^{ns}	3.00	4.82
Error	12	1740.172	145.014			
TOTAL	20	3086.558				

ns = not significant Coefficient of Variation: 10.14%

Appendix Table 8. Fruit diameter (cm)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	3.62	3.50	3.45	10.57	3.523
Thalia (Kaneko)	3.27	3.55	3.28	9.10	3.033
Poinsett (Kaneko)	2.25	3.3	3.4	9.95	3.317
Jaguar (Ramgo)	4.12	4.0	4.13	12.25	4.083
Poinsett 76 (Ferry Morse)	4.02	3.88	3.98	11.88	3.960
General Lee, F_1 (Condor)	3.48	3.38	3.38	10.24	3.413
Poinsett 76 (Kaneko)	3.62	3.32	3.43	10.37	3.457

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	0.165	0.083			
Factor A	6	2.404	0.401	16.82**	3.00	4.82
Error	12	0.286	0.024			
TOTAL	20	2.855				

** = highly significant Coefficient of Variation: 4.36%

Appendix Table 9. Fruit length (cm)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	18.63	18.17	20.08	56.88	18.960
Thalia (Kaneko)	16.52	16.72	17.08	50.32	16.773
Poinsett (Kaneko)	17.33	18.72	17.75	53.80	17.933
Jaguar (Ramgo)	19.93	20.55	20.23	60.71	20.237
Poinsett 76 (Ferry Morse)	18.5	20.18	20.05	58.73	19.577
General Lee, F_1 (Condor)	18.78	18.33	20.08	57.19	19.063
Poinsett 76 (Kaneko)	18.12	17.42	17.6	53.14	17.713

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	1.835	0.917			
Factor A	6	25.631	4.272	9.89 **	3.00	4.82
Error	12	5.186	0.432			
TOTAL	20	32.652				

** = highly significant Coefficient of Variation: 3.53%

Appendix Table 10. Average fruit weight (g)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	316.67	305	267.17	288.84	296.280
Thalia (Kaneko)	300.	267.67	293.33	861.00	287.000
Poinsett (Kaneko)	166.67	163.83	300.33	630.83	210.277
Jaguar (Ramgo)	339.83	335	400.87	1075.70	358.567
Poinsett 76 (Ferry Morse)	348.17	316.83	366.67	1031.67	343.890
General Lee, F_1 (Condor)	316.67	300.5	268.38	885.55	295.183
Poinsett 76 (Kaneko)	172.67	216.67	287.5	676.84	225.613

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	6225.235	3112.617			
Factor A	6	54472.275	9078.712	5.52 **	3.00	4.82
Error	12	19751.916	1645.993			
TOTAL	20	80449.426				

** = highly significant Coefficient of Variation: 14.08%

Appendix Table 11. Marketable yield (kg/5m^{2}plot)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	16.2	15.8	16.4	48.40	16.133
Thalia (Kaneko)	12.6	12.9	14.8	40.30	13.433
Poinsett (Kaneko)	11	14.4	13.1	38.50	12.833
Jaguar (Ramgo)	17.6	16.1	16.2	49.72	16.573
Poinsett 76 (Ferry Morse)	8.6	11	12.3	31.90	10.633
General Lee F1 (Condor)	18.9	16	13.4	48.30	16.100
Poinsett 76 (Kaneko)	12.3	10	14	36.30	12.100

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	1.121	0.561			
Factor A	6	96.613	16.102	4.86**	3.00	4.82
Error	12	39.630	3.302			
TOTAL	20	137.364				

** = highly significant Coefficient of Variation: 13.01%

Appendix Table 12. Non-marketable yield (kg/5m^2 plot)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	2	1.2	1	4.2	1.400
Thalia (Kaneko)	1.5	2	2	5.5	1.833
Poinsett (Kaneko)	2.3	1.2	2	5.5	1.833
Jaguar (Ramgo)	2.1	2.4	3	7.5	2.500
Poinsett 76 (Ferry Morse)	2	2.6	2.4	7.0	2.333
General Lee, F_1 (Condor)	1	2	1.5	4.5	1.500
Poinsett 76 (Kaneko)	2.2	2	1.4	5.6	1.867

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	0.007	0.003			
Factor A	6	2.903	0.484	2.06 ^{ns}	3.00	4.82
Error	12	2.820	0.235			
TOTAL	20	5.730				

ns = not significant Coefficient of Variation: 25.58%

Appendix Table 13. Total yield (kg/5m^2 plot)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	18.2	17.0	17.4	52.60	17.533
Thalia (Kaneko)	14.1	14.9	16.8	45.80	15.267
Poinsett (Kaneko)	13.3	15.6	15.1	44.00	14.667
Jaguar (Ramgo)	19.7	18.5	19.2	57.40	19.133
Poinsett 76 (Ferry Morse)	10.6	13.6	14.7	38.90	12.967
General Lee, F_1 (Condor)	19.9	18	14.9	52.80	17.600
Poinsett 76 (Kaneko)	14.5	12	15.4	41.90	13.967

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	1.235	0.618			
Factor A	6	90.818	15.136	5.19 **	3.00	4.82
Error	12	34.965	2.914			
TOTAL	20	127.018				

** = highly significant Coefficient of Variation: 10.75%

Appendix Table 14. Computed marketable yield (t/ha)

CULTIVAR	REPLICATION			TOTAL	MEAN
	I	II	III		
General Lee, F_1 (Ferry Morse)	32.4	31.6	32.8	96.80	32.267
Thalia (Kaneko)	25.2	25.8	29.6	80.60	26.867
Poinsett (Kaneko)	22	28.8	26.2	77.00	25.667
Jaguar (Ramgo)	35.2	32.2	32.2	99.60	33.200
Poinsett 76 (Ferry Morse)	17.2	22	24.6	63.80	21.267
General Lee, F_1 (Condor)	37.8	32	26.8	96.60	32.200
Poinsett 76 (Kaneko)	24	20	28	72.60	24.200

ANALYSIS OF VARIANCE TABLE

Source	Degrees of freedom	Sum of squares	Mean Square	F Value	Tabular F	
					0.05	0.01
Replication	2	4.690	2.345			
Factor A	6	388.126	64.688	4.91 **	2.00	4.82
Error	12	157.977	13.165			
TOTAL	20	550.792				

** = highly significant Coefficient of Variation: 12.98%