BIBLIOGRAPHY

MOGUIL, MIKIE T. MAY 2008. Growth and Yield Performance of Six Chickpea (*Cicer arietinum l.*) Varieties under Sagada, Mountain Province Condition. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study was conducted to determine the growth and yield performance of six chickpea varieties and to select and evaluate varieties under Pide, Sagada condition.

Findings revealed that although growth, flowering and maturity were significantly different, yield potentials showed no significant differences in the locality. Generally, Desi type (varieties ICCV 95954), performed better than Kabuli type (ICCV 95332 and ICCV 95334). Desi type (ICCV 95954) had the highest yield at 970 kg/ha and thus are the most adopted varieties under the environmental conditions of the locality.

Desi type (ICCV 95954) could be recommended for cultivation since it gives a high yield under Pide, Sagada condition.

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INTRODUCTION

Nature of the Study

One of the municipalities of Mountain Province is Sagada. It is inhabited by mostly people of the Kankana-ey language group. Sagada has a cool climate. Mountainous terrains with slopes of over 18 degrees characterize the municipality. It is studded with high limestone formations and has underground streams and rivers. At an elevation of 5,000 feet above sea level, Sagada is in the western part of Mt. Province. It is bounded in the north by the province of Abra, in the south by the municipality of Sabangan, in the east by the municipality of Bontoc and in the west by Bauko and Besao municipalities.

The municipality has two pronounced seasons, the wet season which lasts from May to October and the dry season from November to April. The wettest part of the year is in October while the dry season peaks in January and February.

Sagada has a total agricultural land area of 527.80 hectares but only 240.75 hectares are covered, thereby serving only 820 farmers. The leading agricultural crop in Sagada is rice followed by root crops, fruits and vegetables.

Chickpea (*Cicer arietinum*) also known as garbanzo, Egyptian pea and gram is an annual cool season legume or pulse crop. It is a significant food crop of the Mediterranean Region and India and is cultivated for its edible nutritious seeds.

It belongs to the Leguminosae family with plant height ranging between 30-70 cm, but tall types with >1.0 m in height are cultivated in the erstwhile USSR. The foliage is covered with glandular hairs which secrets highly acidic exudates, and is considered important in conferring tolerance to insect pest, such as the pod borer. Leaves are compound,

arranged in an alternate, solitary or in inflorescence of 2 or 3. They are white, pink, purplish, or blue in color. The fruit is a legume, 2-3 cm long (0.8-12") and I cm (o.4") wide.

Chickpea is a temperate crop, probably originated in Southeastern Turkey and spread to other parts of the world. Crop improvement efforts have improved adaptation of chickpea to warmer conditions in the subtropics. The two most common types of chickpea are; the seeded "Kabuli" and the "Desi type". Kabuli types are mostly grown in WANA, the Americas and Europe, while the desi types predominate in Asia, parts of Africa and Australia.

Chickpeas mature in 3-7 months and the leaves turn brown or yellow during maturity. For dry seeds, the plants are harvested at maturity by cutting them close to the ground or uprooting. Chickpeas are usually stored in bags, but are more subject to insect damage than when stored in bulk.

Importance of the Study

Chickpea (*Cicer arietinumL.*) has one of the highest nutritional compositions of any dry edible legume. On an average, chickpea seed contains 23%protien, 47% starch, 56% fat, 6% crude fiber, 6% soluble sugar and 3% ash. It is grown ten million hectare of which 74.5% is in India and 1.7% in Burma. It is the most important food legume grown globally. Because it is grown for its nutritious edible seeds, the whole seed or split seed are used in flour for preparing variety of snack, raw or roasted fresh green chickpeas and straw as a livestock feed. The plant is free from various anti-nutritional factors and has high protein (23%), total carbohydrates (64%) and dietary fiber content (19%). Chickpea are rich in minerals and vitamins.

Chickpea is mainly used for human consumption and only a small proportion is used as feed. The kabuli type (white or cream seed coat) is generally used as a whole grains, while desi type (coloured seed coat) is used as whole seeds, dehulled, splits or flour. Chickpea is also known for its use in herbal medicine and cosmetics.

Chickpea however, have not been introduced or cultivated in the Cordilleras even the agro climatic condition is suitable for the production. This is due to lack of information and no available planting materials. The introduction of new highbred ICRISAT cultivars of chickpea coupled with the generation of location specific technologies for the highlands of CAR, chickpea could become a major cash earner. Moreover, the supply of chickpea in the Philippines depends mainly on importation of chickpea from producing countries like India, Turkey, Pakistan, Iran, Mexico, Australia and Canada.

Sustaining the domestic demand, introducing chickpea in the highlands of Cordillera like in Benguet and Mountain Province and increasing yield per area through the selection of adaptable varieties is the cheapest and easiest technology.

Objectives of the Study

The objectives of the study were:

1. Determine the growth and yield performance of six chickpea varieties under Pide, Sagada, Mountain Province.
2. Select varieties of chickpea adopted under Sagada condition.

Place and Time of the Study

This study was conducted in Pide, Sagada, Mountain Province from October 2007 to May 2008.

REVIEW OF LITERATURE

Botany of Chickpea

Taxonomy, morphology and floral biology. *Cicer*, which was classified under Vicieae Alef., was later reported to belong to the monogeneric tribe, Cicereae. The Genus includes 9 annuals and 34 perennial herbs. Cross ability and fertility of hybrids in interspecific crosses have been used as a basis to classify the annuals into 4 crossability groups. The first group includes the cultivated chickpea (*Cicer arietinum* L.). and *C. reticulatum*. Chickpea plants can be described as "stems are branched, erect or spreading, sometimes shrubby much branched, 0.2-1 m tall, glandular pubescent, olive, dark green or bluish green in color. Root system is robust, up to 2 m deep, but major portion up to 60 cm. Leaves imparipinnate, glandular-pubescent with 3-8 pairs of leaflets and a top leaflet (rachis ending in a leaflet); leaflets ovate to elliptic, 0.6-2.0 cm long, 0.3-1.4 cm wide; margin serrate, apex acuminate to aristate, base cuneate; stipules 2-5 toothed, stipules absent. Flowers solitary, sometimes 2 per inflorescence, axillary; peduncles 0.6-3 cm long, pedicels 0.5-1.3 cm long, bracts triangular or tripartite; calyx 7-10 mm long; corolla white, pink, purplish (fading to blue), or blue, 0.8-1.2 cm long. The staminal column is diadelphous (9-1) and the ovary is sessile inflated and pubescent". Pod rhomboid ellipsoid, 1-2 with three seeds as a maximum, and inflated, glandular-pubescent. Seed color cream, yellow, brown, black or green, rounded to angular, seed coat smooth or wrinkled, or tuberculate, laterally compressed with a median groove around two-thirds of the seed, anterior beaked; germination cryptocotylar (Anonymous, 2007).

Ecology of Chickpea

Chickpea is a self pollinated crop. Cross pollination is rare; only 0-1% is reported. Grown usually as rain fed cool-weather crop or as a dry climate crop in semi-arid regions. Optimum conditions include 18-26^{0}C day and 21-29^{0}C night temperatures and annual rainfall of 600-1000 mm. The Palouse region of the states Washington and Idaho appears to be well suited to chickpea and can be characterized as having 18-25^{0}C during the day and 5-10^{0}C during the night and sufficiently long growing season. California is very suited to the chickpea crop and it has thrived in the coastal areas and in the Central Valley. Thrives on a sunny site in a cool, dry climate on spring of the northern hemisphere. "Generally grown on heavy black or red soils with pH 5.5-8.6. Frost, hailstones and excessive rains damage the crop. Though sensitive to cold, some cultivars can tolerate temperatures as low as -9.5^{0}C in early stages or under snow cover. Daily temperature fluctuations are desired with cold nights with dewfall. Relative humidity of 21-41% is optimum for seed setting. In virgin sandy soils or for the first planting in heavier soils, inoculation is said to increase yield by 10-62%. Although spoken of as "day-neutral", chickpea is a quantitative long-day plant, but flowers in every photoperiod (Anonymous, 2007).

Growth Habits

Plants are multiple branched, spreading growth habit annuals ranging from 8-40 inches tall. Some chickpea varieties have compound leaves (8 to 20 leaflets) and some have simple leaves, which are pubescent (hairy) in appearance. Chickpea leaves exude malic and oxalic seeds.

Kabuli (large seeded = 800 seeds/lb) varieties are generally taller than the desi (small-seeded = 1500 seeds/lb) varieties.

Because of its deep tap root system, chickpea can withstand drought conditions by extracting water from deeper in the soil profile.

Flowers (self pollinated) which are borne in groups of two or three are ½ to 1 in. long and come in purple, white, pink or blue color depending upon variety. Each flower produces a short, pubescent pod which is ¾ to inches long and which appears to be inflated. One or two seeds ($^{1}/^{2}$ to 1 inches diameter) are present in each pod. The seeds come with either rough or smooth surfaces and can be crème, yellow, brown, black or green in color. There is a definite groove visible between the cotyledons about two thirds of the way around the seed, with a beak like structure present (Anonymous, 2007).

Environmental Conditions

Climatic requirement. Climate largely determines where, when and what plants to grow. Climate includes consideration of precipitation, humidity, sky condition, temperature, wind and atmospheric pressure which in turn is influenced by location, latitude, season, elevation, time of day and local factors such as drainage (Janick, 1972).

In 1990, Luis stated that the cooler months of the year under highland condition favors an optimum pod setting. Thompson and Kelly (1959) found that a combination of high solar radiation and low temperatures for a period of 25 days markedly increase yield.

Chickpea is a cool season annual crop performing optimally in 70^0 to 80^0F daytime temperature and 64^0 to 70^0F night temperature. They produce good yields in drier conditions because of their deep tap roots. Areas with lighter, well distributed rainfall patterns have produced the highest yields and quality chickpea seeds (Anonymous, 2007).

Soil requirement. Legume crops can be grown in any type of soil provided water is available. They perform best in soil that is granular, fertile, well drained and relatively free

from nematodes and fusarium diseases. Clay loam soil is probably the beat type for commercial production. They thrive in moderately acidic acid soil with a range of 5.0-6.0 (PCARRD, 1975).

Chickpea does best on fertile sandy loam soils with good internal drainage. Good drainage is necessary because even short periods of flooded or waterlogged fields reduce growth and increase susceptibility to root and stem rots.

Seed preparation and germination. Good quality certified chickpea seed should always be used. This seed should be high in germination percentage (over 85%), free from damage and free of weed seeds. Good quality seeds do not need to be treated with an insecticide or fungicide, but if you have had past problems with Pythuim or Rhizoctonia Rots in your fields, you may need to treat your seeds prior to planting (Anonymous, 2007).

Crop Culture

Field cultivation. Chickpeas are propagated from seeds. Seed is broadcast or (more often) drilled in rows 25-60 cm apart, spaced at 10 cm between seeds at a depth of 2-12 cm with soil well pressed down. Seeding rates vary from 25-40 kg/ha to 80-120 kg/ha, depending on the area and seed type. Seeds should be planted using a drill of planter which can deliver the chickpea seed with out damage. Good seed soil contact should be ensured with a press wheel if possible. Because of the high cost of seed and variation in germination rates, you should carefully calibrate your equipment to achieve the proper plant population. Chickpea maybe cultivated as a sole crop, of mixed with barley, mustard, peas, corn, coffee, sweet potato or wheat. In India, chickpeas are also as a catch crop in sugarcane fields and often as a second crop after rice. Although usually considered a dry land crop, chickpeas develop well on rice lands.

Harvesting. Chickpeas mature in 3-7 months and the leaves turn brown or yellow during maturity. The plants are stacked in the field for a few days to dry and later the crop id threshed by trampling or beating with wooden flails. The chaff is separated from the grain by winnowing. Proper cleaning, drying and aeration are necessary to control seed beetles. A thin coating with vegetable oil can reduce storage damage. Sometimes baskets, made from twisted rice straw are used as storage containers.

Yields and economics. Greater and more stable yields are the major goals of plant breeding programs. Chickpea yields usually average 400-600 kg/ha, but van surpass 2000 kg/ha. Yields from irrigated crops are 20-28% higher than yields from rain fed crops. Two types of chickpea are recognized, desi (colored, small seeded, angular and fibrous) and kabuli (beige, large seeded, rams-head shaped with lower fiber content) types. In a 3-cultivar trial in India, dry matter yields ranged from 9400 to 12000 kg/ha. In India and Pakistan, chickpea is retained by growers. In United States and Europe, chickpeas are marketed dried, canned or in various vegetable mixture. Mashed chickpea mixed with oils and spices (humus) is a popular hors d'oeuvre in the Mediterranean Middle East. In 1975 to 1994, on the average, Asia produced 5-6,000,000 MT, yields ranging from 570-766 kg/ha, led by India, which produced 4-5,000,000 MT ranging from 500-900kg/ha; Africa produced 250-364,000 MT with yields ranging from 600-660 kg/ha. North and Central America produced 180-260,000 MT averaging 1600kg/ha (Anonymous, 2007).

Nutritional Value

Legume vegetables are one of the promising vegetable crop produced in the Philippines. The crop is not only important for human nutrition but also for farmers (Mabli, 2004).

Aside from the benefits it provides to man and animals, legumes are beneficial to the soil, for they are replenishers of soil nitrogen. Legumes generally help maintain and conserve soil fertility (Thompson, 1978).

In a survey in 1965, Knott and Deanon (1967) reported that legume ranked fourth in area planted and eight in total peso value among the eleven leading vegetables produced in the country. This means that legume like chickpea is planted to a wide area than other vegetables. Furthermore, chickpea is considered as one of the most important food legume globally, grown in over 40 countries. Chickpea has one of the most important food legumes and does not contain any specific major anti-nutritional factors.

Chickpea protein digestibility is the highest among the dry edible legumes. It is mainly used for human consumption and only a small proportion is used as feed. It is also known for its use in herbal medicine and cosmetics.

Chickpeas are high in carbohydrates and are a good source of protein. They can be eaten as snack. It can also be used to make a type of split pea called DAHL, salads and stews, and they may also be ground into a fine meal. Roasted seeds are as a confection or snack, and sometimes as a coffee substitute. The herbage is low in yield and is toxic to animals (Singh, 1983). In addition to consumption of the whole seed or seed in young pods, chickpeas are sometimes ground to flour and in preparing unlearned bread or sweets (Janick, 1972).

Chickpea meets 80% of its nitrogen requirement from symbiotic nitrogen fixation and can fix up to 140 kg M ha-1 from air. It leaves substantial amount of residual nitrogen behind for subsequent crops and adds much needed organic matter to maintain and improve soil health, long term fertility and sustainability of the ecosystems (Anonymous, 2007).

Traditional Medicinal Uses

Among the food legumes, chickpea is the most hypocholesteremic agent: germinated chickpea was reported to be effective in controlling cholesterol level in rats. “Glandular secretion of the leaves, stems, and pods consists of malic and oxalic acids, giving a sour taste. In India these acids used to be harvested by spreading thin muslin over the crop during the night. In the morning the soaked cloth is wrung out, and the acids are collected in bottles. Medicinal applications include use for aphrodisiac, bronchitis, catarrh, cutamenia, cholera, constipation, diarrhea, dyspepsia, flatulence, snakebite, sunstroke, and warts. Acids are supposed to lower the blood cholesterol levels. Seeds are considered antibilious” (Anonymous, 2007).

MATERIALS AND METHODS

Materials

The materials used in this study were seeds of chickpea, garden tools, fertilizers, record book and identifying pegs.

Methods

The study was conducted at Pide, Sagada, Mountain Province with a temperature of approximately 10^0C- 21^0C and an elevation of 1565 meters above sea level. The garden field that was planted with chickpea was previously planted with cabbage.

Six varieties of chickpea from ICRISAT were introduced and evaluated at Pide, Sagada, Mountain Province where 2-3 promising varieties adopted to Sagada was selected.

Experiment design and treatments. The study was laid out in Simple Randomized Complete Block Design (RCBD) with a minimum of 500 m^2 per replication per location. There were four replications at each location. The seeds were sown singly at 30 cm between rows and 10 cm between hills. The treatment were as follows:

DESI Type	Kabuli Type
T_1 = ICCV 93952	T_4 = ICCV2
T_2 = ICCV 93954	T_5 = ICCV 95332
T_3 = ICCV 94954	T_6 = ICCV 95334

There were 20 sample plants per treatment per replicate selected randomly.

Care and Maintenance. Care and maintenance was done to all samples through out the duration of the study.

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

A. Vegetative Growth

1. Emergence Percentage (%) = this was recorded 15 days from sowing the seeds.

   $$\text{Emergence Percentage} = \frac{\text{number of seedlings emerge}}{\text{Number of seeds sown}} \times 100$$

2. Days from planting to flowering = this was taken at flowering stage.
3. Average height at flowering (cm) = this was taken at flowering stage (first flower).
4. Days from flowering to first harvest = this was noted on the first harvest of seeds.
5. Average number of lateral branches at flowering = this was taken at flowering (first flowers).

   $$\text{Average number of lateral branches} = \frac{\text{\# of lateral branches of sample plants}}{\text{Sample plants}}$$

6. Total number of harvests = this was the number of harvests done during the study.

B. Yield

1. Average weight of pods produced per plant = this was the total number of pods produced by sample plants divided by the number of sample plants.

Average number of pods per plant (g) = $\frac{\text{total \# of pods produced by sample plants}}{\text{Number of sample plants}}$

2. Average seed yield produced / plant (g) = this was the total yield of sample plants divided by the number of samples.

   Average yield/plant (g) = $\frac{\text{total yield of sample plants}}{\text{Number of samples}}$

3. Total yield / plot (kg) = total yield of the experimental plot.
4. Total yield/ha (tons/ha) = yield of experimental plot (20 m^2) (500)
5. Average number of seeds /pod = this was taken at harvesting stage

C. Seed Quality

1. Weight of 1000seeds (kg) = Small, Medium, Big

2. Germination test = this was conducted one month from seed storage using Petri disc and the Ragdoll method.

D. Varietals Characteristics

1. Leaf = the shape, color and other plant characteristics was recorded.
2. Flower/pod = the color of flower / pod was recorded at flowering and at first harvesting stage.
3. Seed = the color, shape and size was recorded at harvesting together with weight of seeds.

E. Incidence of Pest and Diseases

4. Insect pest = insect pest that infest the plant during the cropping season was noted and identified during the vegetative growth and reproductive stages of plant growth.
5. Diseases = plant diseases observed during the cropping season was recorded and the causal organisms was identified including the degree of infestation.

E. Meteorological Data

1. Temperature (^{0}C)
2. Fog (usual time of occurrence and density)

RESULTS AND DISCUSSION

Emergence Percentage

The emergence percentage as presented in Table 1 showed that there were significant differences among the varieties used. Varieties ICCV 93954, ICCV 95954, ICCV 93952 (Desi type) and ICCV 2 had the highest emergence percentage compared to other Kabuli varieties (ICCV 95332 and ICCV95334) with a mean of 70. 25% and 61% respectively.

The result shows that chickpea had a good germination percentage under Pide, Sagada condition.

Number of Days from Planting to Flowering

Table 2 shows highly significant differences on the days from planting to flowering as affected by varieties used. It was observed that ICCV 2, ICCV 95332 and ICCV 95334, a Kabuli variety significantly had flowered earlier compared to the Desi varieties ICCV 93952, ICCV 93954 and ICCV 95954. Desi variety ICCV 93952 appeared to flower 69 days from planting.

Differences on the days to flowering could be attributed to varietal characteristics of the plant where Kabuli type are generally are early maturing compared to Desi type. It is very evident, as shown by the result that chickpea varieties could adapt under Pide, Sagada condition.

Table 1. Emergence percentage

TYPE	VARIETY	MEAN (%)
DESI	ICCV 93952	79.25a
	ICCV 93954	82.00a
	ICCV 95954	81.25a
KABULI	ICCV 2	76.75a
	ICCV 95332	70.25ab
	ICCV 95334	61.00b

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

Average Height at Flowering

The average height at flowering is presented in Table 3. Results showed that Kabuli variety ICCV 95332 and ICCV 2 significantly attained the highest average height at flowering with a mean of 45.08 cm and 40.05 cm. This was followed by variety ICCV 95334 with a mean of 38.50. Shortest height at flowering was observed in the Desi varieties (ICCV 95954, ICCV 93952 and ICCV 93954), with a mean ranging from 33.85 to 35.95.

The observed differences among the chickpea varieties indicate their differential adaptability to local conditions as well as their inherent height potential. Results confirm that Kabuli varieties are generally taller than the Desi varieties (Anonymous, 2007).

Number of Days from Planting to First Harvest

As shown in Table 4, Kabuli variety ICCV 2 significantly performed better than the other varieties in terms of days from planting to first harvest. It was observed that Kabuli varieties ICCV 2 and ICCV 95332 were harvested earlier than Desi varieties ICCV 93954, ICCV 93952 and Kabuli variety ICCV 95334 with a mean ranging from 138-138.75.

Table 2. Number of days from planting to flowering

TYPE	VARIETY	MEAN (days)
DESI	ICCV 93952	69.25a
	ICCV 93954	63.50b
	ICCV 95954	66.00b
KABULI	ICCV 2	39.00d
	ICCV 95332	45.75c
	ICCV 95334	41.25 d

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

It is apparent in the results that the different varieties had varied maturity periods which may be attributed to the climatic condition under Pide, Sagada condition. This result is due to the fact that Kabuli variety ICCV 2 had flowered earlier than the other varieties. It follows the same trend that the first varieties to produce flowers were also the first to have pods.

Table 3. Average height at flowering

TYPE	VARIETY	MEAN (cm)
DESI	ICCV 93952	34.863b
	ICCV 93954	35.95 b
	ICCV 95954	33.850b
KABULI	ICCV 2	40.050ab
	ICCV 95332	45.875a
	ICCV 95334	38.500b

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

Table 4. Number of days from planting to first harvest

TYPE	VARIETY	MEAN (days)
DESI	ICCV 93952	138.25a
	ICCV 93954	138.75a
	ICCV 95954	136.00a
KABULI	ICCV 2	115.25b
	ICCV 95332	133.50a
	ICCV 95334	138.00a

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

Average Number of Lateral Branches

The average number of lateral branches as presented in Table 5 showed that the varieties of chickpea evaluated had no significant differences. However, the varieties ICCV 93952, ICCV 95954 and ICCV 93954 obtained the highest number of lateral branches with a mean ranging from 7.25 to 7.50 respectively.

Total Number of Harvests

As shown in Table 6, ICCV 95954, ICCV 95332 and ICCV 2 had the highest number of harvest ranging from 2.00 to 2.25. However, statistical analysis showed no significant differences among the varieties evaluated. It was observed that least number of harvests ranges from 1.50 to 1.75 respectively.

Table 5. Average number of lateral branches

TYPE	VARIETY	MEAN
DESI	ICCV 93952	7.50a
	ICCV 93954	7.25a
	ICCV 95954	7.50a
KABULI	ICCV 2	6.75a
	ICCV 95332	5.00a
	ICCV 95334	5.75a

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

Average Number of Pods Produced per Plant

Table 7 shows the average number of pods produced per plant. Result showed that ICCV 95954, a Desi variety attained the greatest number of pods produced per plant comparable to ICCV 93952 that obtained the least number of pods with a mean of 22.695 followed by Kabuli varieties with a mean of 24.323 and 24.620.

Nevertheless, statistical analysis showed no significant differences among the varieties evaluated. Result showed that number of lateral branches seems to be related to the number of pods produced. However, Desi variety ICCV 93952 that was observed to have greater number of branches obtained the least number of pods produced per plant. This result is due to the disease, chickpea stunt that infested the evaluated crop during the vegetative growth and flowering stage.

Table 6. Total number of harvests

TYPE	VARIETY	MEAN
DESI	ICCV 93952	1.50a
	ICCV 93954	1.75a
	ICCV 95954	2.25 a
KABULI	ICCV 2	2.00a
	ICCV 95332	2.25a
	ICCV 95334	1.75a

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

Average seed Yield per Plant

The yield per plant showed that significant differences exist among the chickpea varieties studied (Table 8). Result shows that Desi variety ICCV 95954 had the highest yield but did not differ from Kabuli variety ICCV 95332 and ICCV 2, but out yielded Desi varieties ICCV 93952, ICCV 93954 and Kabuli variety 95334 with a mean of 22.25, 22.375 and 23.25.

Results follows the same trend that the more pods produced per plant, the more seed yield produced per plant. How ever, Desi variety ICCV 93954 was observed to have low seed yield. This result is due to the unfilled pods observed during harvesting. Unfilled pods are caused by temperature of below 15^0C – more than 30^0C.

Table 7. Average number of pods produced per plant

TYPE	VARIETY	MEAN
DESI	ICCV 93952	22.695a
	ICCV 93954	26.055a
	ICCV 95954	43.425a
KABULI	ICCV 2	26.438a
	ICCV 95332	24.323a
	ICCV 95334	24.620a

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

Total Yield per Plot

No significant differences were noted among the six chickpea varieties evaluated in Pide, Sagada condition in total yield per plot. Table 9 shows that the yield per plot may indicate adaptability of the chickpea evaluated.

Table 8. Average seed yield / plant

TYPE	VARIETY	MEAN (g)
DESI	ICCV 93952	22.250c
	ICCV 93954	22.375c
	ICCV 95954	28.250a
KABULI	ICCV 2	24.750bc
	ICCV 95332	26.750ab
	ICCV 95334	23.250c

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

Apparently Desi variety ICCV 93952 had the lowest yield which indicates that such varieties are not suited in Pide, Sagada condition. On the other hand, result follow the trend on the average seed yield per plant where Desi variety ICCV 95954 obtained the highest yield followed by Kabuli varieties ICCV 95332 with a mean of 1.867, ICCV 95334 and ICCV 2 with a mean of 1.800.

Computed Yield per Hectare

Computed yield per hectare were noted to have no significant differences among the evaluated varieties. Computed yield per hectare follow the trend of total yield per plot where Desi variety ICCV 95954 had the highest computed yield.

Result shows that ICCV 95954, a Desi variety and ICCV 95332, a Kabuli variety are high yielding based on computed yield and per hectare of the six varieties evaluated under Pide, Sagada. This was attributed to the fact that pods harvested from the variety ICCV 95954 ,a Desi type attained the highest number of lateral branches (Table 05), number of pods produced per plant (Table 07), and the heaviest seed yield produced per plant (Table 08), that resulted to the highest yield per plot.

On the other hand, variety ICCV 93952 attained the least number of pods produced per plant, seed yield per plant and the yield in kilogram and in hectare. The low yield of this variety was due to the pests rodents that ate the seeds, rotting of seeds that is caused by excessive water and was infected with stunt and collar rot. Some were because of unfilled pods or pod abortion during harvesting. Pod abortion is due to high and low temperature during flowering or pod formation (more than 30^0C or less than 15^0C) and incorrect day length.

Table 9. Total yield per plot and per hectare

TYPE	VARIETY	YIELD/KG	YIELD/HA
DESI	ICCV 93952	1.665a	832.50a
	ICCV 93954	1.785a	900.00a
	ICCV 95954	1.940a	970.00a
KABULI	ICCV 2	1.800a	925.00a
	ICCV 95332	1.867a	933.75a
	ICCV 95334	1.800a	903.75a

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

Average Number of Seeds per Pod

Number of seeds per pod is shown in table 10. Statistical analysis showed no significant differences among the varieties used. Result showed that almost all varieties contain only one seed per pod.

Table 10. Average number of seeds produced per plant

TYPE	VARIETY	MEAN
DESI	ICCV 93952	1.448a
	ICCV 93954	1.438a
	ICCV 95954	1.705a
KABULI	ICCV 2	1.425a
	ICCV 95332	1.415a
	ICCV 95334	1.537a

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

Average Seed Diameter

Highly significant differences were noted in seed diameter as affected by the varieties used (Table 11). Result showed that Kabuli varieties are bigger than Desi varieties. However, Kabuli variety ICCV 2 was observed to have smaller size than the other Kabuli varieties ICCV 95332 and ICCV 95334 but bigger than Desi varieties.

Weight of 1000 Seeds

Table 12 shows the weight of 1000 seeds (g) harvested under Pide, Sagada condition. Highly significant differences was noted where Kabuli variety ICCV 95334 obtained the heaviest weight in grams. Result follows the trend of seed diameter where Kabuli varieties had bigger sizes.

The differences in weight are attributed to the difference in varietals characteristics such as sizes as shown in the table above (Table 11). Kabuli varieties ICCV 95334, ICCV 95332, and ICCV 2 had bigger sizes which might have contributed to its weight.

Table 11. Average seed diameter

TYPE	VARIETY	MEAN (g)
DESI	ICCV 93952	0.665d
	ICCV 93954	0.693cd
	ICCV 95954	0.695d
KABULI	ICCV 2	0.763c
	ICCV 95332	0.900b
	ICCV 95334	0.990a

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

Table 12. Weight of 1000 seeds

TYPE	VARIETY	MEAN (g)
DESI	ICCV 93952	195.167e
	ICCV 93954	219.882de
	ICCV 95954	257.200cd
KABULI	ICCV 2	295.868bc
	ICCV 95332	335.500ab
	ICCV 95334	353.668a

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

Germination Test

The table below (Table13) shows the germination test of chickpea evaluated in Pide, Sagada condition Result showed that Ragdoll method significantly performed better than the Petri Disc method. Nevertheless, Desi variety ICCV 93954 significantly had the highest germination percentage in both Rogdoll and Petri Disc among the varieties evaluated followed by a Kabuli variety ICCV 2 with a mean of 86.75 and 60 respectively.

Result showed that Kabuli variety ICCV 95334 attained the lowest germination percentage that coincides from the emergence percentage done in the field. Germination test was done one week after air drying.

Varietals Characteristics

The physical characteristics of six chickpea varieties evaluated in Pide, Sagada condition was noted and recorded. Desi varieties differ from Kabuli varieties in terms of leaf, flower and seed in its shape, color and sizes. Kabuli has oblong with green leaves, white flower with owls head shape and has a medium and big seed shape with white color while

Table 13. Germination test

TYPE	VARIETY	MEAN (%)	
		ROGDOLL METHOD	PETRI DISC METHOD
DESI	ICCV 93952	70.50c	51.25bc
	ICCV 93954	89.25a	81.25a
	ICCV 95954	80.00b	64.75b
KABULI	ICCV 2	86.75ab	60.00b
	ICCV 95332	70.00c	39.25cd
	ICCV 95334	62.00d	35.25d

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

Desi variety has small rounded with dark green leaves, angular and violet flower and a brown small seeds with angular shape.

Incidence of Pest and Disease

Pest and diseases were noted and recorded during the cropping season. The pests that attacked the evaluated crop were shown below. On the other hand, the diseases noted during the study were collar rot, chickpea stunt and wet root rot that infected the crop during the cropping season. Collar rot and wet root rot diseases were observed in all varieties evaluated in Pide, Sagada condition while chickpea stunt were observed in Desi varities.

Table 14. Pest and Diseases

PESTS			DISEASES		
INSECT PEST	ATTACKING STAGE	DEGREE OF INFESTATION	DISEASE	VARIETIES ATTACKED	DEGREE OF INFESTATION
Cutworm	Vegetative Growth	Slight	Chickpea stunt	Desi Varieties	Moderate
Pod Borer	Harvesting	Moderate	Root Rot	Desi	Slight
				Kabuli	Moderate
Rodents	Harvesting	Severe	Collar rot	Desi	Slight
				Kabuli	Slight

Meteorological Data

The table below shows the environmental condition of Pide, Sagada where six varieties of chickpea were evaluated (Table 15). It was observed that the coolest month of Sagada is January, the flowering and pod formation of chickpea in the locality. January was also the month where thickest fog was observed that affected the yield of the crop evaluated.

Table 15. Meteorological data

MONTH	TEMPERATURE			FOG	
	6 am	12nn	6pm	DENSITY	OCCURRENCE
November	15.25 ^{0}C	18^{0}C	16.5^{0}C	thick	morning
December	17.75^{0}C	21.5^{0}C	19.5^{0}C	thin	morning
January	14.5^{0}C	19.5^{0}C	15^{0}C	very thick	morning and afternoon
February	16.5^{0}C	17.5^{0}C	17^{0}C	thin	afternoon
March	15^{0}C	17.5^{0}C	16.5^{0}C	thick	afternoon

Pictorial Presentation

Figure 1. Overview of the experimental field at flowering

Figure 2. Overview of the experimental field at harvesting

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study was conducted in Pide, Sagada, Mountain Province from October to April to determine the growth and yield performance of six chickpea varieties and to select and evaluate the variety adapted in the place.

Findings showed significant differences among the varieties with regards to emergence percentage, number of days from planting to flowering, average height at flowering, number of days from planting to first harvest, average seed yield per plant, average seed diameter, weight of 1000 seeds and in the germination test. As to the yield, result showed no significant differences among the evaluated varieties.

Desi variety ICCV 95954 had the highest seed yield per plant, yield per plot and per hectare, greatest number of pods produced per plant, the greatest number of seeds per pod and greatest number of lateral branches but had the shortest height at flowering followed by a Kabuli variety ICCV 95332 that attained the highest height at flowering but had the lowest number of pods per plant, least number of lateral branches and the number of seeds produced per plant. ICCV 95334 had the lowest emergence percentage with a mean of 61,had the lowest germination test in rogdoll method with a mean of 62 and in Petri disc method with 35.25 mean but had the heaviest weight of 1000 seeds due to its big size seeds.

Conclusion

Based on the results, the variety grown under Sagada condition in terms of high yield are Desi variety ICCV 95954 and Kabuli varieties ICCV 95332 and ICCV 95334.

Recommendation

Based from the result and conclusion, it is therefore recommended that Desi variety ICCV 95954 and Kabuli varieties ICCV95334 and ICCV 95332 be grown in Sagada, Mountain Province for better crop performance. It is recommended that a follow up study with in Mountain Province will be conducted to verify such results.

LITERATURE CITED

ANONYMOUS,2007.Wikipedia,thefreeencyclopedia.Retrieved,July 28,2007.http:/www.google.com.ph.

ANONYMOUS,2007.ICRISATCrops.Retrieved,August 04,2007.http://www.yahoo.com.ph

KNOTT, J.E. et.al. 1967. Vegetable Production in Southeast Asia. UPCA, Los Banos, Laguna.

JANICK,J. 1972. Plant Science: Introduction to World Crops. Freeman and Company. San Francisco. P. 529.

.

LUIS, A. 1990. Growth Yield Performance and Economics of Pole Snap Bean Planted at Different Months Under La Trinidad, Benguet Condition.(Unpub. Thesis) BSU. P.4

MABLI. 2004. Growth and Yield Performance of Bush Snap Bean "Green Crop" Growing in Plants with and with out Introduced Earthworm. B.S. Thesis (Unpub.) BSU, La Trinidad, Benguet. P. 3-6.

PCARRD. 1975. The Philippines Recommends for Vegetable Crops. Philippine Council for Agriculture and Resources. Manila.

SINGH, C.1983. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. India.

THOMPSON, G.W. 1978. Southern Vegetable Crops. American Book Co. New York.

THOMPSON, H.C. and W.C. KELLY. 1959. Vegetable Crops. 5th Edition. MCGRAW-HILL Co. New York.

WALES, E.S. and D.E. BYTH. 1986. Food Legume Improvement for Asian Farming Systems. Khon Kaen. Thailand.

WARE, G. 1975. Producing Vegetable Crops. Thinterstste Printers and Publishing, Inc. Illinois.

APPENDICES

Table 1. Emergence percentage

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	80	75	76	86	317	79.25
	ICCV 93954	80	85	85	78	328	82
	ICCV 95954	74	84	93	74	325	81.25
KABULI							
	ICCV 2	85	65	79	78	307	76.75
	ICCV 95332	65	80	65	65	281	70.25
	ICCV 95334	54	74	53	63	244	61

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	90.167	30.056			
Factor A	5	1310.833	262.167	3.57*	2.90	4.56
Error	15	1102.833	73.522			
Total	23	2503.833				

* = significant Coefficient of Variation: 11.42%

Table 2. Days from planting to flowering

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	69	72	67	69	277	69.25
	ICCV 93954	60	64	66	64	254	63.50
	ICCV 95954	66	68	64	66	264	66.00
KABULI							
	ICCV 2	37	39	41	39	156	39.00
	ICCV 95332	44	46	47	46	183	45.75
	ICCV 95334	41	44	39	41	165	41.25

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	21.458	7.153			
Factor A	5	3689.375	737.875	252.75**	2.90	4.56
Error	15	43.792	2.919			
Total	23	3754.625				

** = highly significant Coefficient of Variation: 3.16%

Table 3. Average height at flowering

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	32.7	33.1	37.43	36.22	139.45	34.863
	ICCV 93954	35.2	36.4	37	35.2	143.80	35.950
	ICCV 95954	33.0	32.5	35.3	34.6	135.40	33.850
KABULI							
	ICCV 2	47.4	46	35.4	31.4	160.20	40.050
	ICCV 95332	54.6	46.4	40	42.5	183.50	45.875
	ICCV 95334	38	40.3	38.7	37	154	38.500

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	57.787	19.262			
Factor A	5	390.160	78.632	4.18*	2.90	4.56
Error	15	280.028	18.669			
Total	23	727.975				

* = significant Coefficient of Variation: 11.32 %

Table 4. Days from planting to first harvest

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	139	137	139	138	553	138.25
	ICCV 93954	139	139	137	140	555	138.75
	ICCV 95954	130	139	137	135	544	136.00
KABULI							
	ICCV 2	108	118	128	107	461	115.00
	ICCV 95332	138	128	137	131	534	133.00
	ICCV 95334	138	138	138	138	552	138.00

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	64.125	21.375			
Factor A	5	1637.708	327.542	13.91*	2.90	4.56
Error	15	353.125	23.542			
Total	23	2054.958				

** = highly significant

Coefficient of Variation: 3.64 %

Table 5. Average number of lateral branches

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	5	6	10	9	30	7.50
	ICCV 93954	6	8	6	9	29	7.25
	ICCV 95954	6	7	8	9	30	7.50
KABULI							
	ICCV 2	8	6	6	7	27	6.75
	ICCV 95332	5	5	5	5	20	5.00
	ICCV 95334	5	6	6	6	23	5.75

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	9.125	3.042			
Factor A	5	21.375	4.275	2.77ns	2.90	4.56
Error	15	23.125	1.542			
Total	23	53.625				

ns = not significant Coefficient of Variation: 18.74%

Table 6. Total number of harvests

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	1	1	2	2	6	1.50
	ICCV 93954	1	2	2	2	7	1.75
	ICCV 95954	1	2	3	3	9	2.25
KABULI							
	ICCV 2	2	2	2	2	8	2.00
	ICCV 95332	2	2	3	2	9	2.25
	ICCV 95334	1	2	2	2	7	1.75

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	3.500	1.167			
Factor A	5	1.833	0.367	2.20ns	2.90	4.56
Error	15	2.500	0.167			
Total	23	7.833				

ns = not significant Coefficient of Variation: 21.30%

Table 7. Average number of pods per plant

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	18.2	25.5	28.64	18.44	90.78	22.695
	ICCV 93954	15.42	49.13	22.40	17.27	104.22	26.055
	ICCV 95954	58.94	41.17	36.60	36.45	173.70	43.425
KABULI							
	ICCV 2	20.29	35.17	18.05	31.70	105.75	26.438
	ICCV 95332	21.29	33.19	21.37	21.44	97.29	24.323
	ICCV 95334	18.88	11.6	31.93	36.07	98.48	24.620

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	196.748	65.583			
Factor A	5	1188.854	237.771	2.132s	2.90	4.56
Error	15	1673.431	111.562			
Total	23	3059.033				

ns = not significant Coefficient of Variation: 37.82%

Table 8. Average seed yield per plant

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	22.0	22.5	22.0	22.5	89.0	22.50
	ICCV 93954	20.5	25.0	22.5	21.5	89.5	22.38
	ICCV 95954	28.5	25.0	30.0	29.5	113	28.25
KABULI							
	ICCV 2	24.5	22.5	22.5	27.0	99.0	24.75
	ICCV 95332	26.0	28.5	28.5	30.0	107	26.75
	ICCV 95334	24.5	25.0	25.0	22.5	93.0	23.25

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	8.948	2.983			
Factor A	5	121.052	24.210	5.15**	2.90	4.56
Error	15	70.490	4.699			
Total	23	200.490				

** = highly significant Coefficient of Variation: 8.81%

Table 9. Total yield per plot

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	1.76	1.69	1.67	1.54	6.66	1.67
	ICCV 93954	1.80	1.67	1.91	1.76	7.14	1.79
	ICCV 95954	2.18	1.83	1.83	1.92	7.76	1.94
KABULI							
	ICCV 2	1.91	1.78	1.78	1.93	7.20	1.80
	ICCV 95332	2.30	1.75	1.75	1.67	7.47	1.87
	ICCV 95334	1.79	1.79	1.79	1.83	7.20	1.80

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	0.294	0.098			
Factor A	5	0.093	0.01	0.36	2.90	4.56
Error	15	0.772	0.051			
Total	23	1.159				

ns = not significant Coefficient of Variation: 12.77%

Table 10. Computed yield per hectare

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	880	845	835	770	3330	832.50
	ICCV 93954	895	895	895	915	3600	900.00
	ICCV 95954	1090	915	915	960	3880	970.00
KABULI							
	ICCV 2	955	890	890	965	3700	925.00
	ICCV 95332	1150	875	875	835	3735	933.75
	ICCV 95334	900	880	955	880	3615	903.75

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	36808.333	12269.444			
Factor A	5	42120.833	8424.167	2.02ns	2.90	4.56
Error	15	62504167	416.944			
Total	23	141433.333				

ns = not significant Coefficient of Variation: 7.09%

Table 11. Average number of seeds per pod

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	1.32	1.32	1.45	1.70	5.79	1.44
	ICCV 93954	1.45	1.48	1.29	1.53	5.75	1.44
	ICCV 95954	2.01	1.81	1.10	1.90	6.82	1.71
KABULI							
	ICCV 2	1.39	1.52	1.09	2.11	6.10	1.53
	ICCV 95332	1.35	1.57	1.17	1.57	5.66	1.42
	ICCV 95334	1.05	1.30	1.79	2.01	6.15	1.54

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	0.779	0.260			
Factor A	5	0.229	0.04	0.63ns	2.90	4.56
Error	15	1.089	0.073			
Total	23	2.097				

ns = not significant

Coefficient of Variation: 17.83%

Table 12. Weight of 1000 seeds

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	234.0	226.0	222.67	208.0	780.67	195.167
	ICCV 93954	220.8	220.8	218.93	219.0	879.0	219.882
	ICCV 95954	242.5	226.1	234.70	235.5	1028.8	257.200
KABULI							
	ICCV 2	314.0	282.6	295.87	291.0	1183.47	295.87
	ICCV 95332	340.0	340.0	335.50	326.5	1342.00	335.500
	ICCV 95334	345.5	351.0	352.17	360.0	1414.67	353.668

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	3338.505	1112.835			
Factor A	5	80013.762	16002.752	19.22**	2.90	4.56
Error	15	12485.985	832.399			
Total	23	95838.251				

** = highly significant

Coefficient of Variation: 10.45%

Table 13. Rogdoll Method

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	70	72	70	70	282	70.50
	ICCV 93954	90	84	94	89	357	89.25
	ICCV 95954	78	82	80	80	320	80.00
KABULI							
	ICCV 2	80	92	88	87	347	86.75
	ICCV 95332	74	68	68	70	280	70.00
	ICCV 95334	60	52	74	62	240	62.00

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	59.167	19.722			
Factor A	5	2273.333	454.667	19.52**	2.90	4.56
Error	15	349.333	23.289			
Total	23	2681.833				

** = highly significant

Coefficient of Variation: 6.32 %

Table 14. Petri Disc method

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	50	44	52	59	205	51.25
	ICCV 93954	62	84	98	81	325	81.25
	ICCV 95954	76	62	5	65	259	64.75
KABULI							
	ICCV 2	66	62	52	60	240	60.00
	ICCV 95332	46	40	32	39	157	39.25
	ICCV 95334	36	34	36	35	141	35.25

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	22.792	7.597			
Factor A	5	5843.208	1168.642	15.022**	2.90	4.56
Error	15	1166.958	77.797			
Total	23	7032.958				

** = highly significant

Coefficient of Variation: 15.95 %

Table 15. Average seed diameter

TYPE	VARIETY	REPLICATION				TOTAL	MEAN
		I	II	III	IV		
DESI							
	ICCV 93952	0.6	0.7	0.68	0.68	2.66	0.665
	ICCV 93954	0.7	0.69	0.72	0.66	2.77	0.693
	ICCV 95954	0.72	0.66	0.72	0.68	2.78	0.695
KABULI							
	ICCV 2	0.76	0.79	0.74	0.76	3.05	0.763
	ICCV 95332	0.87	0.92	0.92	0.8	3.60	0.900
	ICCV 95334	1.03	0.91	0.88	0.94	3.96	0.990

ANALYSIS OF VARIANCE TABLE

Source	Degrees of Freedom	Sum of Squares	Mean of Square	F Value	Computed F	
					0.05	0.01
Replication	3	8.948	2.983			
Factor A	5	121.052	24.210	5.15**	2.90	4.56
Error	15	70.490	4.699			
Total	23	200.490				

** = highly significant Coefficient of Variation: 8.81 %