BIBLIOGRAPHY

EL CID C. CATNAS. April 2010. Influence of Animal Urine and Salt Water Seed Treatment on the Growth and Yield of Organically Grown Pole Snap Bean (*Phaseolus vulgaris*). Benguet State University.

Adviser: Danilo P. Padua, Ph. D.

ABSTRACT

The study was conducted to evaluate the growth and seed yield of organically grown pole snap bean treated with animal urine and salt water and to determine the effect of animal urine and salt water treatment on seed germination and vigor of pole snap bean.

In the laboratory experiment, results revealed that cow and goat urine and salt water treatments did not enhance seed germination, vigor, and dry matter production of pole snap bean.

It was also noted in the field experiment that no significant effect was observed from cow and goat urine and salt water treatments on the growth and seed yield of pole snap bean.

TABLE OF CONTENTS

INTRODUCTION

Common beans are the most important species of the genus *Phaseolus* in terms of number of varieties available and area devoted to its cultivation worldwide. It had become an important food crop not only in parts of Africa and Asia but also in Europe, America and the Pacific Islands (Padua, 1997). Many beans are exceptionally good sources of vegetable protein and are important food staples. Forms include snap beans that are consumed as pods and as seeds (CHARM, 2001).

Aside from the benefits it can give to man and animals, it helps maintain and conserve soil fertility because of its ability to fix free nitrogen from the atmosphere through the action of nitrogen fixing bacteria (*Rhizobium* bacteria) present in its roots.

One major concern of the farmers is to increase seed production. Seed is the starting point for all plant production. Throughout history, mankind has developed plant varieties with higher potential for yield, resistance to pest and pathogens, and suitability for specific uses or areas of cultivation. Since the seed contains all the genetic information needed to release the inherent potential of these efforts, its protection has always been crucial for plant breeders, seed producers, farmers and those involved in crop protection (ESA, 2007).

For generations, farmers struggled to improve the performance of their seeds, and to protect them against pests and diseases. Seed treatment is an affordable and effective way to optimize plant establishment and yield potential. Since seed treatment with synthetic chemicals is not allowed in organic farming, it is important to find alternative methods for seed treatment.

Organic practitioners in La Trinidad and other parts of Benguet are finding altrnative ways to increase crop production and control pest and diseases. Animal urine and salt water for seed treatment had been done before and was found to be effective. It may enhance seed germination, vigor and growth of the crop and may also increase seed production. This study may thus give more information and will help farmers to acquire some more techniques on seed treatment and increasing yield.

The objectives of the study were to evaluate the growth and seed yield of organically grown pole snap bean treated with animal urine and salt water and to determine the effect of animal urine and salt water treatment on seed germination and vigor of pole snap bean.

The treatment of seeds was conducted at the College of Agriculture building AC 210 from November 12-27, 2008 while the field experiment was done at the BSU Organic Demo Farm at Balili, La Trinidad, Benguet from December 2008 to April 2009.

REVIEW OF LITERATURE

Germination of Common Bean

APASSC (1997) stated that beans are adapted to both temperate and tropical areas where there is greater frost free period than 50 days and soils are warm enough to allow seed germination. Bean seed is sensitive to chilling injury when planted in cold soil. It is particularly susceptible during the initial stage of germination, which is referred to as imbibitions. If the soil is cold at this time, permanent damage may occur. If, however, imbibitions occur under warm conditions, the seed can later tolerate cool soil temperatures and still germinate normally. Furthermore, the OSU (2004) added that good germination of bean seed is obtained at soil temperatures of 15.55 C to 28 C. Seed rot is a serious problem at lower temperatures, and seedling injury from soil incorporated herbicides may be increased due to longer exposure times from slow germination.

Seed Treatment

Seed treatment is the oldest practice in plant protection. Its origins can be traced to the 18th century which use brine for the control of cereal smuts (Neergard, 1997). The modern era of seed treatments began with the introduction of organo-mercury fungicides in 1912 which were widely used for several decades. The post-World War II period saw the development of new fungicide chemistry and the first use of seed treatment for insect control. Today, the most widely used application of seed treatment is the traditional one of protecting the germinating seedling against seed-and soil-borne fungi in the period immediately after planting. However, the uses and expectations of seed treatments are greater today due to the impact of environmental regulations that have either banned or

restricted the use of the potential to control bacteria, viruses, insect, and nematodes and provide plant protection well into growing season. Seed treatment technology also has application in control of growth regulators and fertilizers; and sizing and shaping of seeds to facilitate planting. These new uses often require improved application systems to better establish dosages and coverage of materials (McGee 1995).

Efficacy of seed treatment is one of the several factors that influence the cost, risk and benefits of seed treatments. For some crops, such as corn, peanuts, rice and cereals, fungicide seed treatment is routine and there is little argument that seed treatment is a necessary and effective means of protecting seeds and seedlings from seed borne pathogens. After almost 30 years of continual use, seed treatment in maize using captan Pedersen *et al* (1986) reevaluated the need for this practice and reached the conclusion that it was essential to assure stand establishment. In expensive organo-mercury seed treatments use in the U.K, cereal diseases were rare or unknown (Yarham and Jones *et al* 1992). According to (Richardson 1986, Sutherland *et al* 1994), the replacement of organo-mercurials with more expensive products has led several studies of benefits of seed treatment of cereals in the U.K. In these reports, no benefit to yield was evident in plots grown from treated compared to untreated seeds. At individual sites, however, significant differences were evident. Because control of seed-borne pathogens is a major reason for seed treatment, Brodal (1993) suggested that decisions to apply seed treatments should be determined by seed health test results.

Inadequacy of Chemical Seed Treatment

Application practices are usually determined by relating seed treatment rates to subsequent emergence and yield in a series of field tests in different locations and under a

variety of environmental conditions. If repeated often enough, this type of experiment may provide reasonably reliable information on application rates, but very little information is obtained about disease epidemiology. As a result, failures in control practices cannot be explained and more fungicides tend to be used than are necessary (McGee 1995).

At least one major crop failure, resulting in multimillion dollar court settlements, has since been attributed to the inadequacies of research into efficacy of the product (McGee, 1981). With some crops, such as soybean; the need for seed treatment has always been unclear. An extensive epidemiological study of soybean seed treatment (Wall *et al.,* 1983) led to the precise definition of conditions under which soybean seed treatment could be justified. An important characteristic of this recommendation is that the grower can easily obtain the required information to make the decision to use seed treatment. Economic and environmental considerations will require that seed treatment products developed in the future be applied at low and efficient dosages.

Animal Urine and Salt Water as an Agent for Organic Seed Treatment

Excess nitrogen from digested protein is excreted in the urine as urea in cow and goat. It contains 2/3 of the N and 4/5 K discharged by these animals and these elements are more quickly available because they are in solution. Urine also is a good activator for converting crop residues to humus Cow urine was found very suitable to treat seeds of some crops (like finger millet) for good germination and seedling vigor. Cow urine extract is also an agent to control seed borne pathogens (Shridhar, 2000).

Kaufman (2000) found that salt water treatment is a useful technique in separating healthy seeds form unhealthy ones. This treatment is found to be very effective in treating paddy seeds.

MATERIALS AND METHOD

The study was conducted in both laboratory and field conditions, using similar treatments. The laboratory portion deal mainly with germination and seedling biomass production while the field experiment was done up to seed production. B-21 bought from BSU-IPBHCRS, a potential variety of pole snap bean was used.

Cow and goat urine were collected at Tawang, La Trinidad, Benguet one day before sowing both in the laboratory and field experiment while sea water was obtained from Bangar, La Union two days before sowing. Dilution was done by using graduated cylinder wherein lower concentration was first formulated before formulating the treatment with higher concentration. Seeds were soaked in urine and salt water for 30 minutes and air dried in a shaded area.

Experiment A. Laboratory Condition

A germination tray measuring 28 cm x 38 cm x 10 cm was filled with sieved sand before seeds were planted. A total of 24 trays were used to accommodate three replications. The experiment was set in completely randomized design (CRD). One hundred seeds were evenly sown in each tray. Watering of the seeds was done everyday for two weeks to supply the moisture needed.

The following were the seed treatments:

Code	Treatment
T_1	Control (no treatment)
T_2	Water soaked only (18 hrs.)
T_3	1:10 cow urine and water dilution (soak 30 minutes before sowing)

T_4 1:5 cow urine and water dilution (soak 30 minutes before sowing)

T_5 1:10 goat urine and water dilution (soak 30 minutes before sowing)

T_6 1:5 goat urine and water dilution (soak 30 minutes before sowing)

T_7 100% salt water (soak 30 minutes before sowing)

T_8 50% salt water (soak 30 minutes before sowing)

Data Gathered

1. Days to germination. This was recorded by counting the number days from sowing to first germination.

2. Percent germination. This was obtained by using the formula

$$\%\text{Germination} = \frac{\text{Number of Seeds Germinated}}{\text{Number of Seeds Sown}} \times 100\%$$

3. Seedling vigor/ vigor index. This was determined using the formula:

$$\text{Vigor} = \frac{\#\text{of normal seedling } (1^{st} \text{ count})}{\text{Days to } 1^{st} \text{ count}} + \ldots\ldots + \frac{\#\text{of normal seedling (last count)}}{\text{days to last count}}$$

4. No. of ungerminated seeds. This was recorded by counting the number of ungerminated seeds.

5. No. of normal seedlings. This was recorded by counting the number of normal seedlings based on visual observation.

6. No. of abnormal seedlings. This was recorded by counting the number of abnormal seedlings through visual observation.

7. Seedling height. This was obtained by measuring five sample plants per tray from the base to the tip of the plant two weeks after planting.

8. Length of hypocotyls and epicotyls. This was obtained by measuring five sample plants per tray two weeks after planting.

9. Dry matter production. This was obtained by weighing ten plant samples two weeks after planting and computed using the formula:

$$\% \text{ Moisture Content} = \frac{\text{Fresh weight} - \text{Oven dry weight}}{\text{Oven dry weight}} \times 100\%$$

$$\text{Dry Matter (\%)} = 100\% - \% \text{ Moisture Content}$$

Experiment B. Field Condition

An area of 240 m^2 was thoroughly prepared and divided into 24 plots. Each plot was measured 1 m x 10 m. The experiment was laid out following the randomized complete block design (RCBD) with three replications. Two seeds were planted in each hole of double row plots with a distance of 20 cm between rows and hills. Mushroom compost was applied basally two weeks before planting while Yama-bym (Processed Chicken Manure) was used during hilling up. Corn was planted on the borders of the area to serve as barrier while marigold was planted in between beds to serve as pest repellants. All necessary cultural management practices were done uniformly in all plots.

Data Gathered

A. Vegetative Characters

1. Days to emergence. This was recorded by counting the number of days from planting to the time when at least 50% of the plants in the plot fully emerged.

2. Days from planting to flowering. This was obtained by counting the number of days from planting up to the time the plants started to produce flowers.

3. Leaf color. This was obtained through visual observation.

4. Plant height at maturity (cm). This was taken by measuring the plant height from the ground level to the tip of the vine using meter stick after the last harvest.

B. Percent Germination. This was obtained by using the formula

$$\% \text{ Germination} = \frac{\text{Number of Seeds Germinated}}{\text{Number of Seeds Sown}} \times 100\%$$

C. Flower Characters

1. Number of flower per cluster. The number of flowers per cluster per plant were recorded from ten sample plants per plot.

2. Flower color. This was obtained through visual observation.

D. Pod Characters

1. Number of pod per cluster. The number of pods per cluster per plant were recorded from ten sample plants per plot.

2. Pod color. This was obtained through visual observation.

3. Pod length (cm). Ten random sample pods were selected per treatment and measured using a ruler.

4. Pod width (cm). This was obtained by selecting ten random samples per treatment and measured using a ruler.

E. Percentage Pod Set. This was determined by using the formula:

$$\% \text{ Pod set} = \frac{\text{Total Number of Pod Set}}{\text{Total Number of Flowers}} \times 100\%$$

F. Yield Characters

1. Number of seeds per pod. The number of seeds per pod was obtained from ten random sample pods per treatment.

2. Total seed yield per plot (kg). The total seed yield per plot was recorded from each treatment.

3. Seed length (mm). This was obtained by measuring ten random samples per treatment.

4. Weight of one hundred seeds (g). This was taken by weighing 100 seeds at 10% MC.

H. Bean Rust and Pod Borer Reaction.

1. Bean rust. This was observed using the following rating scale (Cayso, 2005):

Scale	Description	Remarks
0	No infection	high resistance
1	1-25% of the total plants are infected	mild resistance
2	26-50% of the total plants are infected	moderate resistance
3	51-75% of the total plants are infected	susceptible
4	76-100% of the total plants are infected	very susceptible

2. Pod borer. This was observed using the following rating scale (Cayso, 2005):

Scale	Description	Remarks
0	No infestation	high resistance
1	1-25% of the total plant are infested	mild resistance
2	26-50% of the total plant are infested	moderate resistance
3	51-75% of the total plant are infested	susceptible
4	76-100% of the total plant are infested	very susceptible

Analysis of Data

All quantitative data were statistically analyzed using analysis of variance (ANOVA) in CRD for experiment A and RCBD for experiment B with three replications. The significance of differences among the treatment means were tested using the Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSIONS

A. Effect of Animal Urine and Salt Water on the Germination, Vigor and Dry Matter Production of Pole Snap Bean

Days to Germination, Percent Germination and Vigor Index

Results showed no significant differences on the number of days from sowing to germination, percent germination, and vigor index (Table 1).

Seed germination in all treatments took three to four days after sowing indicating that the treatments did not enhance germination.

No significant differences were also observed among the treatments on percent germination. It was clear though that all treatments had much higher germination percentage compared to the control and water-soaked seeds. The goat and cow urine were particularly effective in enhancing seed germination by about 16-24%. Salt water treatment also increased seed germination by 14-15%.

Table 1. Days to germination, percent germination, and vigor index of pole snap beans

TREATMEANTS	DAYS TO GERMINATION	PERCENT GERMINATION	VIGOR INDEX
Control	4	68.67	35.42
Water soaked only	3	68.33	33.78
1:10 CU + W	3	90.00	45.14
1:5 CU + W	3	88.33	45.29
1:10 GU + W	3	84.00	43.39
1:5 GU + W	3	92.67	49.74
100% salt water	4	83.33	41.28
50 % salt water	3	82.33	42.83
CV (%)	16.41	13.38	14.98

Abbreviations: CU= Cow Urine, GU= Goat Urine, W= Water

The beneficial effect of goat and cow urine as well as salt water treatment was further affirmed by the much higher vigor index of the seeds subjected to these treatments.

Number of Ungerminated Seeds and Normal and Abnormal Seedlings

No significant differences in the number of ungerminated seeds and abnormal seedlings were noted while significant differences in the number of normal seedling were observed among pole snap bean seed treatments (Table 2).

Pole snap bean seeds treated with 1:10 cow urine and water, 1:5 cow urine and water, and 1:5 goat urine and water had more normal seedlings than those in the unsoaked and water soaked seeds. This result is due to the very low seed germination in unsoaked (control) and water soaked seeds.

No significant differences were observed on the number of abnormal seedlings because each treatment had only 1-2 abnormal seedlings.

Table 2. Number of ungerminated seeds and normal and abnormal seedlings

TREATMEANTS	NUMBER OF		
	UNGERMINATED SEEDS	NORMAL SEEDLINGS	ABNORMAL SEEDLINGS
Control	31	66[b]	2
Water soaked only	32	66[b]	2
1:10 CU + W	10	90[a]	1
1:5 CU + W	12	88[a]	1
1:10 GU + W	16	83[ab]	1
1:5 GU + W	7	92[a]	1
100% salt water	17	82[ab]	2
50 % salt water	18	81[ab]	1
CV (%)	25.81	13.01	35.97

*Means with common letter are not significant different at 5% level of DMRT.

Length of Hypocotyl and Epicotyl
Seedling Height

Differences on the length of hypocotyl, epicotyl and seedling height of the eight treatments were not significant (Table 3). The length of hypocotyls and epicotyls ranged from 18.88 cm to 22.67 cm and 31.67 cm to 36.77 cm respectively while the seedling height ranged from 40.83 cm to 43.47 cm. Goat and cow urine and salt water treatments did not affect the growth of pole snap bean.

The nitrogenous constituents, potassium and other elements found in cow and goat urine might have already been used up in the early stage of growth of the seedlings thus the growth elongation of the hypocotyl and epicotyl and the height of the seedling were not enhanced.

Dry Matter Production

Table 4 presents the dry matter production of pole snap bean seedlings. No significant differences were noted on the eight treatments indicating that cow and goat urine and salt water had no effect on biomass production.

Table 3. Length of hypocotyl and epicotyl and seedling height two weeks after sowing

TREATMEANTS	LENGTH (cm) OF		SEEDLING
	HYPOCOTYL	EPICOTYL	HEIGHT (cm)
Control	21.74	34.79	42.22
Water soaked only	22.31	33.52	41.31
1:10 CU + W	19.80	32.41	41.67
1:5 CU + W	20.48	36.77	43.47
1:10 GU + W	22.67	31.67	40.83
1:5 GU + W	18.11	34.88	43.31
100% salt water	19.01	34.52	40.48
50 % salt water	18.88	34.58	42.55
CV (%)	12.33	9.44	6.29

Table 4. Percent dry matter production two weeks after sowing

TREATMENTS	DRY MATTER PRODUCTION (%)
Control	9.46
Water soaked only	8.55
1:10 CU + W	9.12
1:5 CU + W	8.80
1:10 GU + W	8.69
1:5 GU + W	10.09
100% salt water	9.14
50 % salt water	8.16
CV (%)	8.37

According to Bristow and Whitehead *et al.* (2006), total N in cow urine ranges from 6.8 to 21.6 g N litre^{-1} while goat urine ranged from 3.0 to 13.7 g litre^{-1}. It contains S, Cu, Fe, PO_4, Na, K, Mn, Ca, and other minerals (Kedia *et al*, 2008) but it is not sufficient to enhance the dry matter production of pole snap bean.

B. Effect of Animal Urine and Salt Water on the Growth and Seed Yield of Pole Snap Bean

Days From Sowing to Emergence and Flowering

Table 5 shows the number of days from sowing to emergence and flowering. Significant differences were observed in the two parameters.

Table 5. Days from sowing to emergence and flowering

TREATMENTS	DAYS FROM SOWING TO	
	EMERGENCE	FLOWERING
Control	10[a]	44[a]
Water soaked only	8[b]	43[b]
1:10 CU + W	9[a]	44[a]
1:5 CU + W	9[a]	44[a]
1:10 GU + W	9[a]	44[a]
1:5 GU + W	9[a]	44[a]
100% salt water	9[a]	44[a]
50 % salt water	9[a]	44[a]
CV (%)	4.49	0.99

*Means with common letter are not significant different at 5% level of DMRT

The seeds soaked in water only started to emerge eight days after sowing while unsoaked seeds emerged ten days after sowing. Results show that cow and goat urine and salt water donnot enhance the emergence of bean seed.

Longer days of emergence of the seeds might be attributed to soil clods in each plot that may have delayed seed emergence.

Seeds soaked in water only were the first to produce flowers at 43 days after sowing while all the rest flowered one day later. Since water soaked seeds were the first to emerge, it grew and developed earlier and also produced flowers earlier than the other treatments. This result implies that cow and goat urine and even salt water are not efficient in enhancing emergence and flowering of pole snap bean.

Percent Germination

Results showed no significant differences on percent germination (Table 6). The recorded percent germination ranged from 80.78 to 88.43 percent. This trend was almost similar to that of the laboratory experiment. Interestingly, compared to similar treatment

Table 6. Percent germination and plant height at harvest

TREATMENTS	% GERMINATION	PLANT HEIGHT (cm)
Control	83.33	331.69
Water soaked only	81.63	332.22
1:10 CU + W	80.78	331.10
1:5 CU + W	84.18	333.04
1:10 GU + W	88.43	329.65
1:5 GU + W	83.50	330.92
100% salt water	86.05	331.87
50 % salt water	82.31	333.24
CV (%)	4.15	0.46

in the laboratory experiment unsoaked (control) and water soaked seeds had higher germination percentage.

Although no significant differences were observed, the highest percentage germination was attained by seeds soaked in 1:10 goat urine and water with a mean of 88.43% followed by seeds soaked in 100% salt water with 86.05 percent germination. The lowest percent germination was obtained by seeds soaked in 1:10 cow urine and water (80.78%).

Plant Height at Last Harvest

No significant differences were noted on the plant height at last harvest. This trend was similar to that of the laboratory experiment. The recorded height of the plants ranged from 329.65 cm to 333.24 cm.

Number of Flowers Per Cluster, Pods Per Cluster and Percent Pod Set

The number of flowers per cluster, pods per cluster and percent pod set are shown in Table 7. No significant differences were observed among the parameters. The number

of flowers per cluster was five to six while the number of pods per cluster was three to four.

Low percent pod set among the eight treatments could be attributed to strong rain during the flowering stage of the crop that increased the abortion of flowers and early development of pods.

Pod length, Pod Width, and Seed Length

Table 8 shows the pod length and width and seed length of the pole snap bean. No significant differences were observed among the eight treatments in these three parameters. The pod length and width ranged from 14.88 -15.06 cm and 1.16 -1.19 cm respectively.

The seed length in the different treatments ranged from 12.23 mm- 12.50 mm.

Table 7. Number of flowers and pods per cluster, and percent pod set

TREATMENTS	NUMBER OF		PERCENT POD SET
	FLOWER PER CLUSTER	PODS PER CLUSTER	
Control	6	4	57.05
Water soaked only	5	3	55.11
1:10 CU + W	6	3	59.50
1:5 CU + W	5	4	53.41
1:10 GU + W	6	4	60.16
1:5 GU + W	6	4	66.18
100% salt water	6	3	55.44
50 % salt water	6	3	58.09
CV (%)	8.59	14.77	10.10

Table 8. Pod length and width, and seed length

TREATMENTS	POD		SEED
	LENGTH (cm)	WIDTH (cm)	LENGTH (mm)
Control	14.91	1.17	12.30
Water soaked only	14.96	1.16	12.23
1:10 CU + W	15.06	1.18	12.40
1:5 CU + W	14.82	1.18	12.33
1:10 GU + W	14.83	1.19	12.50
1:5 GU + W	14.88	1.18	12.43
100% salt water	15.03	1.16	12.30
50 % salt water	14.93	1.17	12.23
CV (%)	0.91	1.15	1.41

Weight of 100 Seeds and Seed Yield per Plot

Results show no significant differences among the different treatments on weight of 100 seeds and total seed yield per plot (Table 9). This indicates that the cow and goat urine and salt water treatments used did not affect the yield of pole snap beans. It was noted that the weight of 100 seeds ranged from 29.40- 29.90 g while seed weight per plot ranged from 2.54kg-2.71 kg.

Table 9. Weight of 100 seeds (g) and total seed yield per plot (kg)

TREATMENTS	100- SEED WEIGHT (g)	TOTAL SEED YEILD PER 10 m^2
Control	29.60	2.60
Water soaked only	29.73	2.65
1:10 CU + W	29.93	2.56
1:5 CU + W	29.90	2.57
1:10 GU + W	29.40	2.54
1:5 GU + W	29.67	2.57
100% salt water	29.90	2.71
50 % salt water	29.90	2.58
CV (%)	1.33	6.50

Number of Seeds Per Pod

The number of seeds per pod in all the treatments was eight. This result indicates that cow and goat urine and salt water had no effect on increasing the number of seeds per pod of pole snap bean.

Leaf Color, Flower Color and Pod Color (Color Chart)

It was observed that seeds soaked in water only showed darker green leaf color from two to three weeks after sowing. At five weeks, all the treatments had the same dark green leaves. No differences in flower and pod color were observed among the eight treatments.

Reaction to Bean Rust and Pod Borer

Based on the results, B-21 showed mild resistance to bean rust and pod borer. The occurrence of bean rust and pod borer was observed at 75 DAP and 90 DAP respectively when 1-25% of the plants were affected.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study was conducted both in laboratory and field conditions to evaluate the growth and seed yield of organically grown pole snap bean treated with animal urine and salt water, possibly enhance seed germination and vigor of pole snap bean through animal urine and salt water treatment, and determine the effect of animal urine and salt water treatment on the control of seed born diseases of pole snap bean. The laboratory experiment was conducted at the College of Agriculture building while the field experiment was done at the BSU Organic Demo Farm at Balili, La Trinidad, Benguet from November 2008 to April 2009.

Cow and goat urine and salt water were collected and used as seed treatment agents in B-21, a potential variety of pole snap bean. The same treatments were applied in the laboratory and field experiments.

In the laboratory experiment, seeds were sown in trays and were observed within a two-week duration. Results showed that only the number of normal seedlings was significantly different while the other parameters considered in this study were statistically comparable among treatments. Pole snap bean seeds treated with 1:10 cow urine and water, 1:5 cow urine and water, and 1:5 goat urine and water significantly had more normal seedlings than unsoaked seeds (control) and those soaked in water only.

In the field experiment, significant differences were noted among the eight treatments on the number of days to emergence and flowering. Seeds soaked in water only emerged and flowered earlier than the other treatments at 8 days and 43 days after sowing respectively.

It was noted that seeds soaked in water only exhibited darker green leaf color from two to five weeks after sowing. The following week, all the treatments had the same dark green leaves. No differences were observed in flower, pod and seed color.

B-21 showed mild resistance to bean rust at 75 DAP and to pod borer at 90 DAP. No significant differences in other parameters including seed yield were observed.

Conclusion

The cow and goat urine and salt water treatments did not affect the growth and seed yield of pole snap bean. The treatments did not also enhance seed germination and vigor of pole snap bean. Similarly, resistance of pole snap bean to bean rust and pod borer were not enhanced by the animal urines and salt water treatments used. However, the resistance shown by B-21 makes it suitable for organic production.

Recommendation

Although no appreciable effect was found on the growth and seed yield of pole snap bean, treatment of seeds with cow and goat urine and salt water could still be recommended for uniform emergence. However, varying the treatments such as the ratio of dilution or duration of soaking could produce more meaningful result. B-21 could be recommended for organic production.

LITERATURE CITED

ATLANTIC PROVINCES AGRICULTURAL SERVICES COORDINATING COMMITTEE (APASCC). 1997. Bean (snap).Atlantic Provinces Agricultural Services Coordinating Committee. Accessed at http://www.nsac.ns.ca/.

BRISTOW, A. W. and WHITEHEAD D. C. 2006. Nitrogenous constituents in the urine of cattle, sheep and goats. AFRC Institute of Grassland and Environmental Research, Hurley Research Station, Maidenhead, Berkshire SL6 5LR, UK. Accessed at http:// www3.interscience.wiley.com/journal.

BRODAL, G. 1993. Fungicide treatment of cereals according to the need in Nordic countries. Proc. Crop Prot. North Brit. Pp 7-16.

CAYSO, A. L. 2005. Performance of ten pole snap bean (Phaseolus vulgaris L.) varieties under Basil, Tublay, Benguet condition. BS Thesis (Unpub.) BSU, La Trinidad, Benguet. Pp 11-12

CORDILLERA HIGHLAND AGRICULTURAL RESOURCE MANAGEMENT (CHARM). 2001. Snap beans Technoguides for Technicians. DA-CHARM, Baguio City Pp 1, 35.

EUROPEAN SEED ASSOCIATION (ESA). 2007. Better Regulation for Plant Protection Products for Seed Treatment and Minor Uses. Accessed at http://www.euroseeds.org/position-papers/PP 2007/ESA_2007.

KAUFMAN, E. R. 2000. Organic Seed Treatments Notes. Accessed at http://www.grow seed.org/seed treatment notes. hmtl.

KEDIA P. M. 2008. Cow Wealth Non-Milk Products. World Cow Resource Center. Accessed at http://www.worldcow .org/cow_wealth.html

MCGEE, D. C. 1981. Seed pathology: its place in modern seed production. Plant Dis. 65:638-42.

MCGEE, D. C. 1995. Advances on Seed Treatment Technology. Seed Science Center, Iowa University, Ames, IA 50011, USA. Accessed at http://www.green-seeds.com/pdf/seed_treat.pdf.

NERGAAD, P. 1997. Seed Pathology, Vols. I, II. John Wiley and Sons, New York.

OREGON STATE UNIVERSITY (OSU). 2004. Snap Beans, Commercial Vegetable Production Guide. Oregon State University, Corvallis, Oregon. Accessed at http://hort-devel-nwrec.hort.oregonstate.edu/snapbean.html.

RICHARDSON, M. J. 1986. An assessment of the need for routine use of organ mercurial cereal seed treatment. Field Crop Res. 13:3-24.

SHRIDHAR, S. 2000. Organic vegetable gardening. Center for Indian Knowledge Systems. Chennai. P 40.

SUTHERLAND, K. G., WALE, S. J., and OXLEY, S. J. P. 1994. Evaluation of broad spectrum seed treatments for the control of cereal foliar diseases in Scotland. Pages 53-62 in seed treatment: Progress and Prospects Mono. 57, BCPC, Thornton Health, UK.

WALL, M. T., MCGEE, D. C. and BURRIS, J. S. 1983. Emergence and yield of fungicide treated soybeans differing in quality. Agron. J. 75:969-973.

YARHAM D. J. and JONES, D. R. 1992. The forgotten diseases: why should we remember them? Proc. Brighton Crop Prot. Pest Dis. 3: 1117-1126.

APPENDICES

Experiment A. Laboratory Condition (CRD)

Appendix Table 1. Days to germination

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	4	3	4	11	4
T_2	2	3	3	8	3
T_3	3	3	3	9	3
T_4	3	4	3	10	3
T_5	3	3	4	10	3
T_6	3	3	4	10	3
T_7	3	4	4	11	4
T_8	3	4	3	10	3
TOTAL	24	27	28	79	26

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	2.292	0.327	$1.1.12^{ns}$	2.66	4.03
Error	16	4.667	0.292			
Total	23	6.958				

^{ns}- Not Significance Coefficient of Variation= 16.41%

Appendix Table 2. Percent germination

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	89	79	38	206	68.667
T_2	64	79	62	205	68.333
T_3	91	88	91	270	90.000
T_4	92	84	89	265	88.333
T_5	82	83	87	252	84.000
T_6	93	92	93	278	92.667
T_7	89	88	73	250	83.333
T_8	88	75	84	247	82.333
TOTAL	688	668	617	1973	657.666

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	1763.958	251.994	2.08^{ns}	2.66	4.03
Error	16	19636.000	121.000			
Total	23	3699.958				

^{ns}- Not Significance Coefficient of Variation= 13.38%

Appendix Table 3. Vigor index

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	47.42	40.70	18.14	106.26	35.420
T_2	31.80	38.96	30.57	101.33	33.777
T_3	42.22	47.85	45.34	135.41	45.137
T_4	47.75	41.47	46.39	135.88	45.293
T_5	41.81	44.33	44.04	130.18	43.393
T_6	49.43	49.87	49.91	149.21	49.737
T_7	47.28	39.37	37.19	123.84	41.280
T_8	46.56	38.90	43.03	128.49	42.830
TOTAL	354.27	341.45	315.11	1010.60	333.867

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	583.545	83.364	2.09^{ns}	2.66	4.03
Error	16	637.026	39.814			
Total	23	1220.572				

^{ns}- Not Significance Coefficient of Variation= 14.98%

Appendix Table 4. Number of ungerminated seeds

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	11	21	62	94	31
T_2	36	21	38	95	32
T_3	9	12	9	30	10
T_4	8	16	11	35	12
T_5	18	17	13	48	16
T_6	7	8	7	22	7
T_7	11	12	27	50	17
T_8	12	25	16	53	18
TOTAL	112	132	183	427	143

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	1763.958	251.994	2.08^{ns}	2.66	4.03
Error	16	1936.000	121.000			
Total	23	3699.958				

^{ns}- Not Significance Coefficient of Variation= 25.81%

Appendix Table 5. Number of normal seedlings

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	86	76	37	199	66
T_2	60	77	61	198	66
T_3	91	87	91	269	90
T_4	92	83	89	264	88
T_5	81	81	87	249	83
T_6	92	92	93	277	92
T_7	85	87	73	245	82
T_8	86	75	83	244	81
TOTAL	673	658	614	1945	648

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	2091.625	298.804	2.69*	2.66	4.04
Error	16	1779.333	111.208			
Total	23	3870.958				

*- Highly Significance Coefficient of Variation= 13.01%

Appendix Table 6. Number of abnormal seedlings.

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	3	3	1	7	2
T_2	4	2	1	7	2
T_3	0	1	0	1	1
T_4	0	1	0	1	1
T_5	1	2	0	3	1
T_6	1	0	0	1	1
T_7	4	1	0	5	2
T_8	2	0	1	3	1
TOTAL	15	10	3	28	11

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	15.333	2.190	1.59^{ns}	2.66	4.03
Error	16	22.000	1.375			
Total	23	37.333				

^{ns}- Not Significance Coefficient of Variation= 35.97%

Appendix Table 7. Length of hypocotyl (cm)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	21.88	20.94	22.40	65.22	21.740
T_2	19.50	23.16	24.26	66.92	22.307
T_3	18.18	21.04	20.18	59.40	19.800
T_4	18.60	23.00	19.84	61.44	20.480
T_5	22.92	20.30	24.80	68.02	22.673
T_6	15.30	19.56	22.48	54.34	18.113
T_7	17.76	18.30	20.96	57.02	19.007
T_8	19.88	18.00	18.78	56.64	18.880
TOTAL	154.02	164.30	173.7	489.00	163

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	61.323	8.760	1.39^{ns}	2.66	4.03
Error	16	100.947	6.309			
Total	23	162.270				

^{ns}- Not Significance Coefficient of Variation= 12.33%

Appendix Table 8. Length of epicotyl (cm)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	29.28	35.64	39.44	104.64	34.787
T_2	34.62	30.46	35.48	100.56	33.520
T_3	32.28	30.02	34.92	97.22	32.407
T_4	35.70	37.72	36.90	110.32	36.773
T_5	29.10	33.14	32.78	95.02	31.673
T_6	30.80	35.38	38.46	104.64	34.880
T_7	35.04	34.00	34.52	103.56	34.520
T_8	32.75	39.96	31.04	103.75	34.583
TOTAL	259.57	276.32	283.54	819.43	273.143

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	53.143	7.592	0.73^{ns}	2.66	4.03
Error	16	166.290	10.393			
Total	23	219.433				

^{ns}- Not Significance Coefficient of Variation= 9.44%

Appendix Table 9. Seedling height (cm)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	39.66	42.24	44.76	126.66	42.220
T_2	41.18	37.10	45.64	123.92	41.307
T_3	41.84	38.88	44.28	125.00	41.667
T_4	43.34	42.42	44.68	130.40	43.467
T_5	39.64	39.92	42.92	122.48	40.827
T_6	41.74	39.68	48.52	129.94	43.313
T_7	40.10	41.10	41.32	122.52	40.840
T_8	41.48	45.96	40.20	127.64	42.547
TOTAL	328.98	327.30	352.32	1008.56	336.188

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	22.599	3.228	0.38^{ns}	2.66	4.03
Error	16	135.148	8.447			
Total	23	157.747				

^{ns}- Not Significance Coefficient of Variation= 6.92%

Appendix Table 10. Biomass production (%)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	9.763	8.339	10.274	28.376	9.459
T_2	8.059	8.163	9.443	25.665	8.555
T_3	8.278	9.046	9.990	27.314	9.105
T_4	9.793	7.696	8.912	26.401	8.800
T_5	8.066	9.309	8.706	26.081	8.694
T_6	10.134	9.767	10.363	30.264	10.088
T_7	9.312	8.883	9.212	27.407	9.136
T_8	9.397	8.912	8.176	24.485	8.162
TOTAL	72.802	70.115	75.076	215.993	71.999

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Treatment	7	7.374	1.053	1.85^{ns}	2.66	4.03
Error	16	9.090	0.568			
Total	23	16.464				

^{ns}- Not Significance Coefficient of Variation= 8.37%

Experiment B. Field Condition (RCBD)

Appendix Table 11. Days to emergence

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	10	10	9	29	10
T_2	8	8	8	24	8
T_3	9	10	9	28	9
T_4	9	9	10	28	9
T_5	9	9	9	27	9
T_6	9	10	9	28	9
T_7	9	9	9	27	9
T_8	9	9	9	27	9
TOTAL	72	74	72	218	72

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	0.333	0.167	4.43**	2.77	4.28
Treatment	7	5.167	0.738			
Error	14	2.333	0.167			
Total	23	7.833				

**- Highly Significant Coefficient of Variation=4.49%

Appendix Table 12. Days from planting to flowering

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	45	44	44	133	44
T_2	43	43	43	129	43
T_3	44	43	44	131	44
T_4	44	44	44	132	44
T_5	44	44	44	132	44
T_6	43	44	44	131	44
T_7	44	45	44	133	44
T_8	44	44	44	132	44
TOTAL	351	351	351	1053	351

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	0.000	0.000	2.97**	2.77	4.28
Treatment	7	3.958	0.565			
Error	14	2.667	0.190			
Total	23	6.625				

** - Highly Significant Coefficient of Variation=0.99%

Appendix Table 13. Percent germination

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	78.57	83.67	87.76	250.00	83.333
T_2	80.61	84.18	80.10	244.89	81.630
T_3	83.16	78.06	81.12	242.34	80.780
T_4	86.73	77.04	88.76	252.53	84.177
T_5	87.24	86.22	91.84	265.30	88.433
T_6	86.22	78.06	86.22	250.50	83.500
T_7	89.80	82.14	86.22	258.16	86.053
T_8	85.20	80.61	81.12	246.93	82.310
TOTAL	677.53	649.98	683.14	2010.65	670.216

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	78.753	39.376	1.52^{ns}	2.77	4.28
Treatment	7	129.120	18.446			
Error	14	169.523	12.109			
Total	23	377.396				

^{ns}- Not Significant Coefficient of Variation=4.15%

Appendix Table 14. Plant height at maturity (cm)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	334.92	330.90	329.24	995.06	331.687
T_2	333.41	332.24	331.02	996.67	332.223
T_3	331.23	330.43	331.63	993.29	331.097
T_4	332.47	332.43	334.21	999.11	333.097
T_5	330.24	330.15	328.55	988.94	329.647
T_6	332.65	329.26	330.86	992.77	330.923
T_7	333.26	329.77	332.57	995.6	331.867
T_8	334.54	334.64	330.56	999.72	333.240
TOTAL	2662.72	2649.82	2648.64	7961.16	2653.72

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	15.207	7.604	1.77^{ns}	2.77	4.28
Treatment	7	28.925	4.132			
Error	14	32.695	2.335			
Total	23	76.695				

^{ns}- Not Significant Coefficient of Variation=0.46%

Appendix Table 15. Number of flowers per cluster

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	7	6	5	18	6
T_2	6	5	5	16	5
T_3	6	6	5	17	6
T_4	6	5	5	16	5
T_5	7	6	5	18	6
T_6	6	6	6	18	6
T_7	6	6	5	17	6
T_8	7	5	6	18	6
TOTAL	51	45	42	138	46

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	5.250	2.625	1.07^{ns}	2.77	4.28
Treatment	7	1.833	0.262			
Error	14	3.417	0.244			
Total	23	10.500				

^{ns}- Not Significant Coefficient of Variation=8.59%

Appendix Table 16. Number of pods per cluster

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	4	3	4	11	4
T_2	3	3	3	9	3
T_3	3	4	3	10	3
T_4	3	3	4	10	3
T_5	3	4	4	11	4
T_6	4	3	4	11	4
T_7	3	3	3	9	3
T_8	3	3	3	9	3
TOTAL	26	26	28	80	27

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01

Replication	2	0.376	0.188	1.29[ns]	2.77	4.28
Treatment	7	2.227	0.318			
Error	14	3.442	0.246			
Total	23	6.046				

[ns]- Not Significant Coefficient of Variation=14.77%

Appendix Table 17. Percent pod set (%)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	54.258	48.048	68.81	171.143	57.048
T_2	55.573	58.000	51.762	165.335	55.112
T_3	51.048	64.258	63.167	178.500	59.500
T_4	52.000	52.143	56.100	160.243	53.414
T_5	48.571	61.429	70.476	180.476	60.159
T_6	64.166	66.048	68.33	198.544	66.181
T_7	49.036	57.285	60.001	166.322	55.441
T_8	50.536	66.453	57.287	174.276	58.092
TOTAL	425.188	473.664	495.933	1394.84	464.947

ANALYSIS OF VARIANCE

SOURCE OF	DEGREE OF	SUM OF	MEAN OF	COMPUTED F	TABULAR F	
					O.05	0.01

VARIANCE	FREEDOM	SQUARES	SQUARES			
Replication	2	326.903	163.451	1.37^{ns}	2.77	4.28
Treatment	7	331.706	47.387			
Error	14	482.357	34.454			
Total	23	1140.965				

^{ns}- Not Significant Coefficient of Variation=10.10%

Appendix Table 18. Pod length (cm)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	15.13	14.75	15.06	44.94	14.980
T_2	15.12	14.90	14.85	44.87	14.957
T_3	15.09	15.23	14.86	45.18	15.060
T_4	15.01	14.70	14.74	44.45	14.817
T_5	14.84	14.79	14.87	44.48	14.827
T_6	14.84	14.86	14.94	44.64	14.880
T_7	15.14	14.85	15.11	45.10	15.033
T_8	14.91	14.81	15.07	44.79	14.930
TOTAL	120.08	118.89	119.5	358.45	119.484

ANALYSIS OF VARIANCE

SOURCE OF	DEGREE OF	SUM OF	MEAN OF	COMPUTED F	TABULAR F	
					O.05	0.01

VARIANCE	FREEDOM	SQUARES	SQUARES			
Replication	2	0.086	0.043	1.31^{ns}	2.77	4.28
Treatment	7	0.170	0.170			
Error	14	0.258	0.258			
Total	23	0.514	0.514			

^{ns}- Not Significant Coefficient of Variation=0.91%

Appendix Table 19. Pod width (cm)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	1.17	1.18	1.16	3.51	1.170
T_2	1.16	1.17	1.16	3.49	1.163
T_3	1.19	1.17	1.18	3.54	1.180
T_4	1.21	1.16	1.17	3.54	1.180
T_5	1.19	1.19	1.19	3.57	1.190
T_6	1.21	1.17	1.17	3.55	1.183
T_7	1.17	1.16	1.15	3.48	1.160
T_8	1.16	1.17	1.18	3.51	1.170
TOTAL	9.46	9.37	9.36	28.19	9.396

ANALYSIS OF VARIANCE

SOURCE	DEGREE	SUM	MEAN	COMPUTED	TABULAR F

OF VARIANCE	OF FREEDOM	OF SQUARES	OF SQUARES	F	O.05	0.01
Replication	2	0.001	0.000	1.76^{ns}	2.77	4.28
Treatment	7	0.002	0.000			
Error	14	0.003	0.000			
Total	23	0.006				

^{ns}- Not Significant Coefficient of Variation=1.15%

Appendix Table 20. Seed length (mm)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	12.1	12.5	12.3	36.9	12.300
T_2	12.3	12.1	12.3	36.7	12.233
T_3	12.4	12.3	12.5	37.2	12.400
T_4	12.4	12.2	12.4	37.0	12.333
T_5	12.5	12.2	12.8	37.5	12.500
T_6	12.4	12.4	12.5	37.3	12.433
T_7	12.2	12.3	12.4	36.9	12.300
T_8	12.1	12.3	12.3	36.7	12.233
TOTAL	98.4	98.3	99.5	296.2	98.732

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	0.111	0.055	1.39^{ns}	2.77	4.28
Treatment	7	0.192	0.027			
Error	14	0.276	0.020			
Total	23	0.578				

^{ns}- Not Significant Coefficient of Variation=1.14%

Appendix Table 21. Weight of 100 seeds (g)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	29.6	29.6	29.6	88.8	29.600
T_2	29.1	29.9	30.2	89.2	29.733
T_3	29.3	30.3	30.3	89.8	29.933
T_4	30	29.4	30.3	89.7	29.900
T_5	29.5	29.2	29.5	88.2	29.400
T_6	29.2	29.9	29.9	89	29.677
T_7	30.2	29.4	30.1	89.7	29.900
T_8	29.8	30.3	29.6	89.7	29.900
TOTAL	236.7	238	239.5	714.1	238.043

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	0.493	0.247	0.69^{ns}	2.77	4.28
Treatment	7	0.760	0.109			
Error	14	2.207	0.158			
Total	23	0.903				

^{ns}- Not Significant Coefficient of Variation=1.33%

Appendix Table 22. Total seed yield per plot (kg)

TREATMEANTS	REPLICATION			TOTAL	MEAN
	I	II	III		
T_1	2.70	2.62	2.48	7.80	2.600
T_2	2.40	2.98	2.57	7.95	2.650
T_3	2.37	2.71	2.61	7.69	2.563
T_4	2.49	2.53	2.69	7.71	2.570
T_5	2.31	2.57	2.74	7.62	2.540
T_6	2.36	2.8	2.56	7.72	2.573
T_7	2.39	2.74	2.99	8.12	2.707
T_8	2.25	2.73	2.81	7.79	2.597
TOTAL	19.27	21.68	21.45	62.4	20.8

ANALYSIS OF VARIANCE

SOURCE OF VARIANCE	DEGREE OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	TABULAR F	
					O.05	0.01
Replication	2	0.442	0.221	0.31^{ns}	2.77	4.28
Treatment	7	0.061	0.009			
Error	14	0.400	0.029			
Total	23	0.903				

^{ns}- Not Significant Coefficient of Variation=6.50%