

# **Influence of Bokashi Organic Fertilizer and Effective Microorganisms (EM) on Growth and Yield of Field Grown Vegetables**

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## **Abstract**

**Cabbage:** Results show that Bokashi applied 20 and 40 days before transplanting (DAT) plus EM-1 applied 0, 20, 40 DAT in combination with fertilizer applied at planting performed statistically similar with the farmer's practice. Height of cabbage plants on farmer's practice plots were taller than other treatments. Significantly lower yield was noted on plants applied with Bokashi or EM-1 alone and the untreated than any other treatments.

**Lettuce:** Bokashi and EM-1 applied singly or combined did not increase the height of lettuce plants. Plots applied with chicken manure + NPK at recommended rate (farmer's practice) were taller than any other plants in the experiment. However, weight of lettuce heads from plots applied with NPK (1/2RR) + Bokashi and EM-1 was more than the rest of the treatments. This was followed by EM-1 alone. The least number of marketable lettuce heads was recorded in plots applied with chicken manure + NPK at RR. This was due to soft rots, a soil borne disease, that attack the plants.

**Potato:** Mean height between treatments did not differ statistically. However, plants from plots applied with NPK at RR were the tallest; with a difference of one to two centimeters at 30 DAP. At 60 DAP, the tallest plants were from plots applied with chicken manure + NPK at RR with 5 to 6 cm more than other treatments. Generally, the incidence of wilting caused by *Pseudomonas solanacearum* in potato was lower on plots applied with Bokashi alone and EM-1 alone than farmer's practice. More excellent tuber sizes were observed in plots applied with Bokashi + EM-1 over the usual farmer's practice, that is, chicken manure + NPK at RR indicated that the product can sufficiently supply the nutrients needed by the crop for better yield production.

## **Introduction**

Benguet and the Mountain Province of the Philippines are noted for producing delicious tasting temperate vegetables. Potatoes and cabbage are the two leading crops and the list of green salads will not be complete if lettuce is absent. Like other temperate vegetables grown in the highlands, potatoes, cabbage and lettuce are produced with excessive use of fertilizers to promote growth and pesticides to control diseases and insect pests attacking the crops. With the above mentioned practices, the soil becomes dependent on fertilizers and crop plants to pesticides. It is very common to apply chicken manure at 6 tons/ha before planting and 20 bags (1 ton) complete fertilizer (14 -14 -14), at split application before anyone could produce potato, cabbage or any crop. There are places in Benguet where the rate of inorganic fertilizer is more than 20 bags. This may have given rise to the development of soil borne diseases. The following were the objectives of this study: 1) to determine the effects of Kyusei EM-1 and Bokashi on the growth and productivity of potato, cabbage, and lettuce; and 2) to compare the effects of Kyusei EM-1 and Bokashi with inorganic fertilizers on potato, cabbage, and lettuce as tests crops.

## **Materials and Methods**

The study was conducted at the Benguet State University experimental farm from November 1995 to February 1996. An area of about 1,000 m<sup>2</sup> was prepared. The area was divided into 3 blocks and assigned to cabbage, lettuce and potato. There were 3 replications per treatment. The treatments (Table 1 for cabbage and lettuce and for potato an additional treatment was included, that is, Bokashi followed by EM-1). Treatments were laid out in randomized complete block design and the test materials studied were applied as indicated. The following data were gathered to assess the efficacy of the formulations: 1) plant height (cm), 2) yield (kg), and 3) incidence of soil borne diseases.

**Table 1. Fertilizer Treatment, Rate and Methods of Application used in Cabbage and Lettuce.**

Treatment	Time of Application	
	Pre –planting (0,10,15,30 days before planting)	Vegetative – Reproductive Stage
Untreated (control)	None	None
Bokashi alone	2,000kg/ha applied 30 DBT	500 kg/ha applied 0,20,40 DBT
EM – 1 alone	10 l/ha 1:500 pw applied 30 days before transplanting	10 l/ha 1:500 pw applied 0,20,40 days after planting
NPK at recommended rate	120 –60 –60 kg/ha incorporated in the soil before planting	120 kg N applied at 30 days after planting
Bokashi and EM- 1	Bokashi 2,000 kg/ha applied 30 days before planting EM-1 10 l/ha 1:500 pw applied 30 days before planting	Bokashi 500 kg/ha applied 0,20,40 days after planting EM-1 10 l/ha 1:500 pw applied 0,20,40 days after planting
NPK at ½ RR + Bokashi and EM-1	NPK 120 –30 –30 kg/ha applied at planting	Bokashi 500 kg/ha applied 20,40 days before planting EM-1 10 l/ha 1:500 pw applied 0,20,40 days after planting
Bokashi and EM-1 + NPK at ½ RR	Bokashi 2,000 kg/ha applied 30 days before planting EM-1 10 l/ha 1:500 pw applied 30 days before transplanting	NPK 120 –30 –30 kg/ha applied 30 days after planting
NPK at ½ RR	60 –30 –30 kg NPK/ha. inc. in the soil	60 kg/ha applied 30 DAP
Farmer’s Practice	120 –30 –30 kg NPK/ha chicken manure incorporated in the soil	120 –30 –30 NPK/ha applied 30 days after planting

## Results

### Treatment Effects on Height and Yield of Cabbage and Lettuce

Fig 1a presents the mean height of cabbage 30 and 60 days after transplanting (DAT) and the yield in tons/ha. Height of cabbage plants 30 DAT did not differ significantly from each other but the shortest came from the untreated. At this early stage of growth, the effects of different treatments were evidently manifested. At 60 DAT, the tallest were still those applied with chicken manure + NPK at RR or farmer’s practice. This was followed by NPK at 1/2 RR + Bokashi and EM-1. Plants applied with 1/2 RR of inorganic, Bokashi and EM-1 alone and the untreated were again the shortest. This only means that these treatments may be unable to supply the necessary nutrients required to attain normal growth.

Plants applied with full recommended rate of inorganic fertilizers yielded similarly with those applied with Bokashi + EM-1 +1/2RR and the farmer’s practice. While these treatments did not differ significantly, plants applied with 1/2 RR + Bokashi and EM-1 gave more yields numerically.

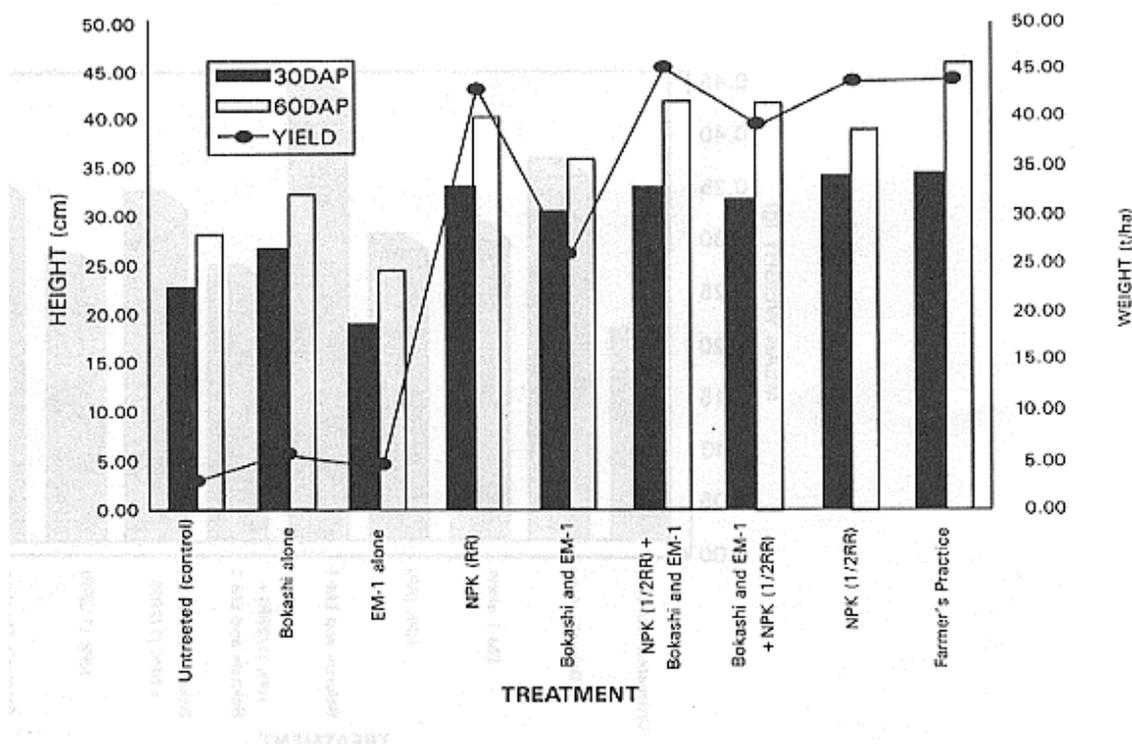
The lowest yield was the untreated with only 3.0kg/ 10 sq. m.

On lettuce (Fig. 1b), at 30 DAT, NPK at 1/2RR + Bokashi and EM-1 were the tallest with a mean height of 27.30 cm. Except for Bokashi alone and EM-1 alone that statistically differed from each other, the rest of the treatments means did not differ in height statistically. At 60 DAT, plants from plots applied with EM-1 were the shortest and the tallest were from plots applied with chicken manure + NPK at RR 9 farmer's practice. Plots applied with NPK at 1/2 RR + Bokashi and EM-1 and Bokashi + EM-1 + NPK at 1/2 RR also produced taller plants than those applied with single or combined Bokashi and EM-1.

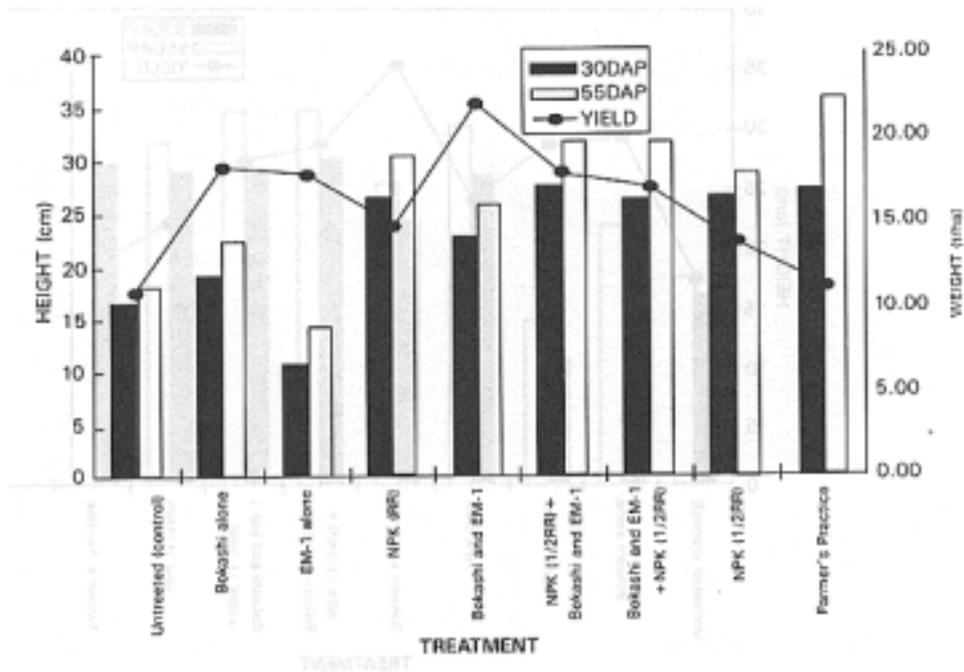
More and heavier lettuce heads (Fig.1b and Fig 2a) was also noted in plots applied with Bokashi and EM-1. The weight of lettuce heads from the untreated or control plots was similar with those plants applied with chicken manure + RR or the farmer's practice.

### Treatment Effects on Height, Yield and Wilted Potato Plants

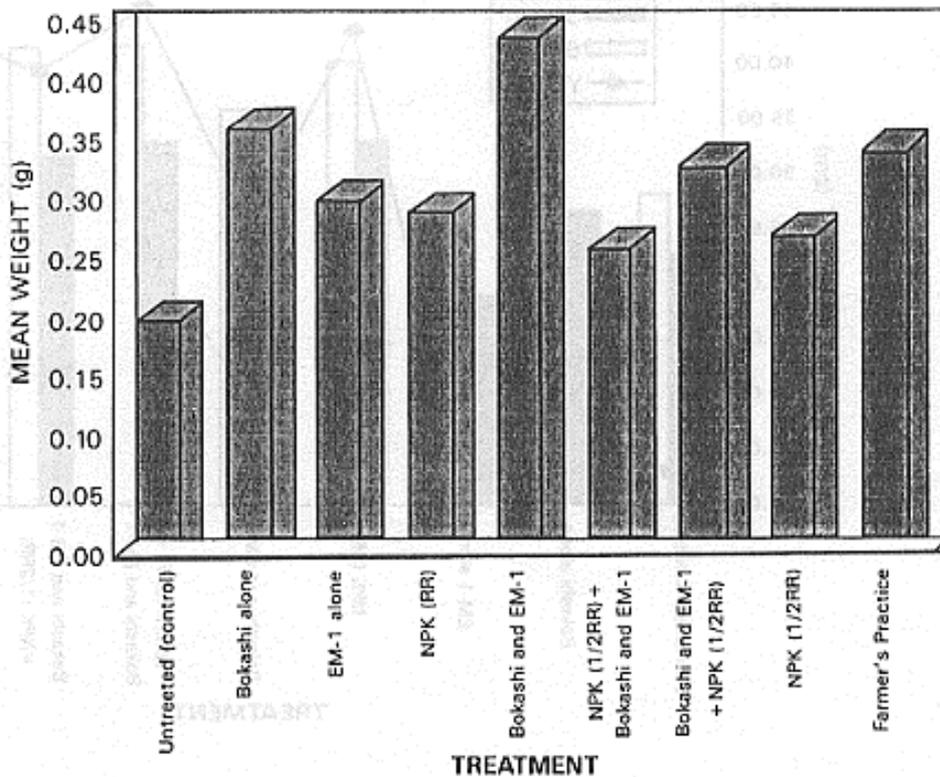
Fig. 2b shows the mean height of potato plants 30 and 60 DAP and the total marketable as affected by the treatments. At 30 DAP, the heights ranged from 34.40cm to 37.06cm. but did not differ statistically with each other. At 60 DAP, the tallest plants with a mean of 56.10cm was recorded from plots applied with chicken manure + NPK at RR (farmer's practice). Plants from plots applied with Bokashi followed by EM-1 were the shortest with a mean height of 48.10cm. Bokashi + EM-1 – applied plots produced more potato tubers (Fig. 2b). The yield difference of four to five tons per hectare in plots applied with Bokashi + EM-1 over the farmer's practice is a good indication of the products potential to be a substitute to chicken manure + NPK at RR. Bokashi alone gave a yield higher than EM -1 alone, with difference of 4 tons/ha, in this trial. Furthermore, more wilted plants (Fig. 3a) were recorded in plots with inorganic fertilizer than Bokashi and EM-1.



**Fig. 1a. Mean Height (cm) of Cabbage Plants 30 and 60 DAT and Yield (t/ha) as Affected by the Treatments**



**Fig. 1b. Mean Height of Lettuce Plants 30 and 55 DAT and Yield (t/ha) as Affected by the Treatments**



**Fig 2a. Average Weight (g) of Lettuce Head as Affected by the Treatments**

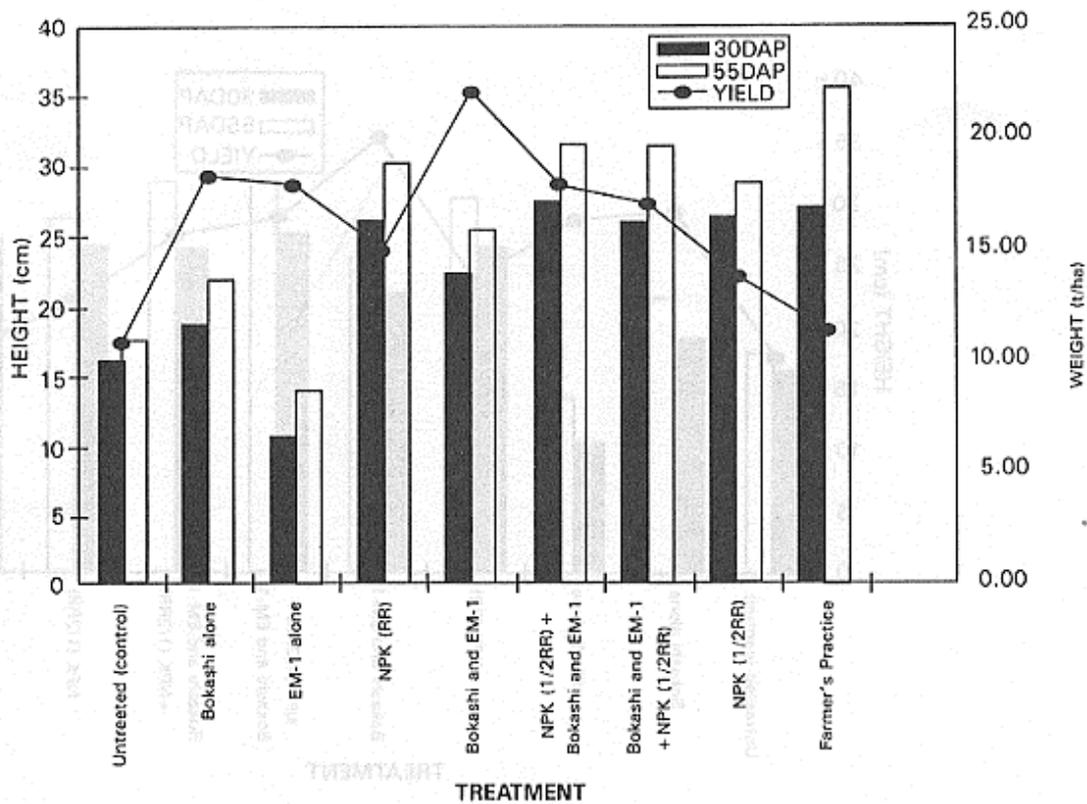


Fig. 2b. Mean Height of Potato Plants 30 and 60 DAP and Yield (t/ha)

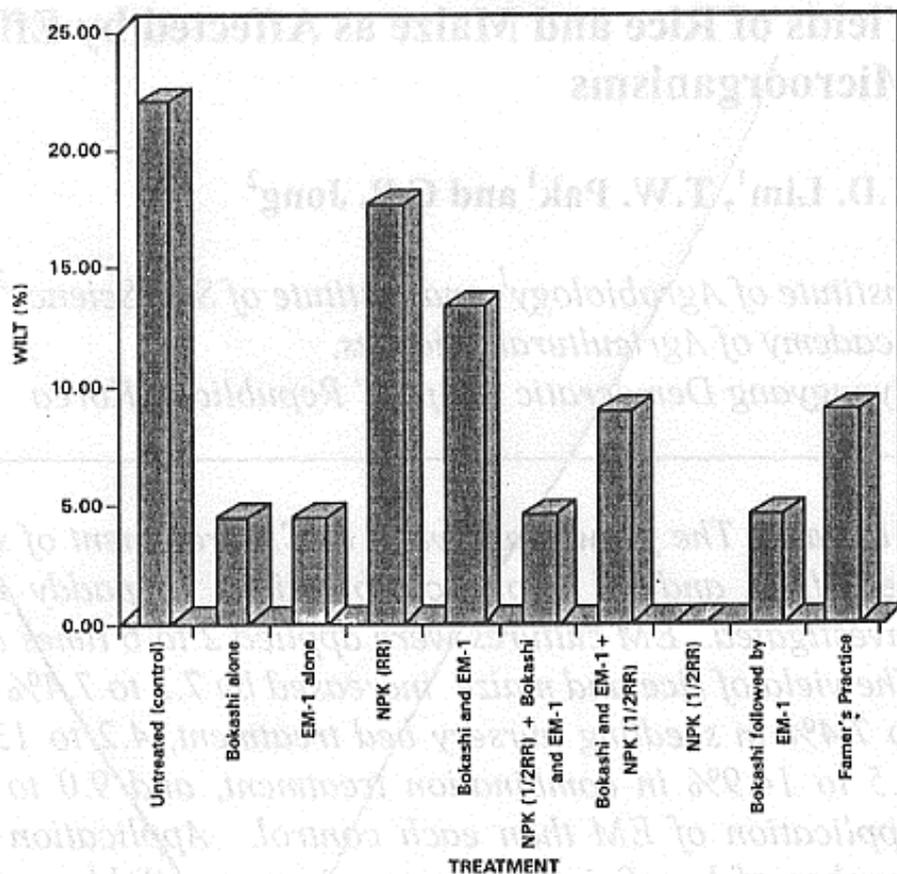
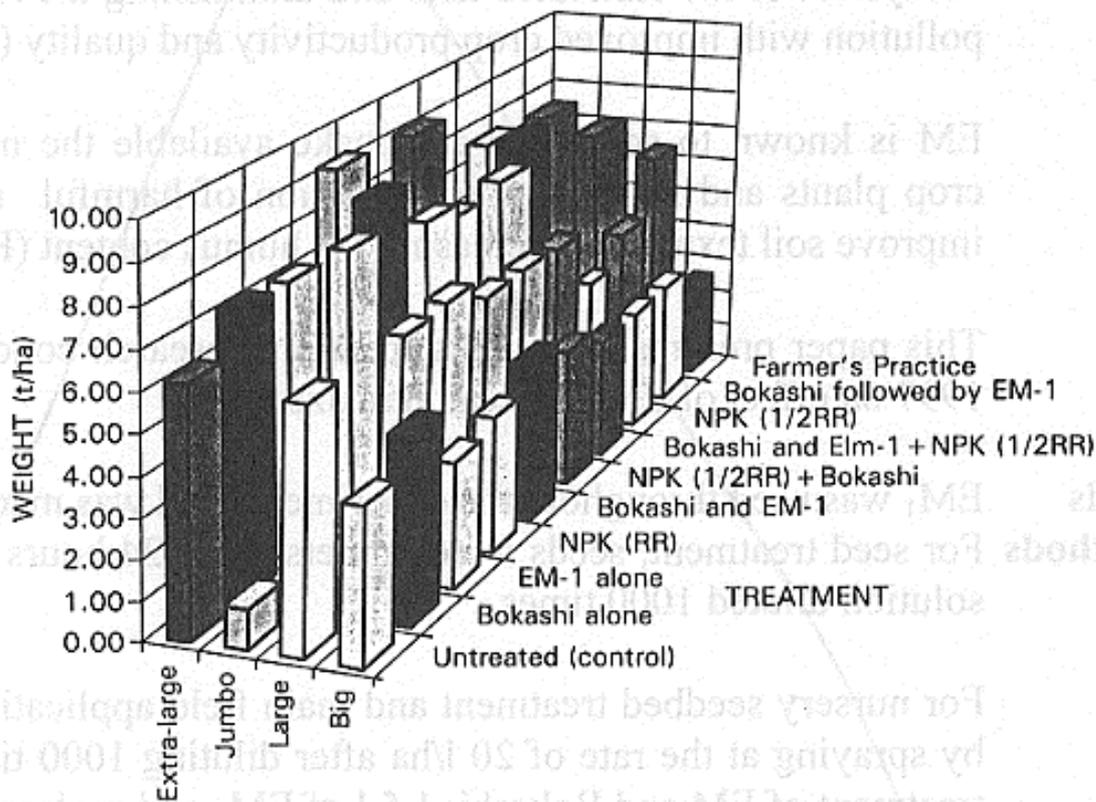


Fig. 3a. Percentage Wilted Plants Caused by *Pseudomonas solanacearum* as Affected by the Treatments



**Fig. 3b. Weight of Classified Potato Tubers as Affected by the Treatments (Jumbo => 13.0cm diam)**

### Discussion and Conclusion

On cabbage, Bokashi + EM-1 combined with inorganic fertilizer yielded similarly with the farmer's practice of applying chicken manure in combination with inorganic fertilizer. Applying Bokashi and EM-1 alone however, cannot sustain growth and yield of cabbage. Likewise, this study revealed that cabbage must be fertilized. The applications of Bokashi and EM-1 applied singly or in combination may not amply provide the requirement of cabbage. When applied however, in combination with inorganic fertilizers, at 50 percent of the recommended rate it performed similarly with the farmer's practice and the full application of recommended rate of inorganic fertilizer.

On lettuce, the results suggests that NPK being present in the treatment supported the organic fertilizers (Bokashi and EM-1) in promoting the growth of the plant. The lowest number of marketable heads from plots applied with chicken manure + NPK (RR) was due to soft rots that attack the plants. Lettuce from plots with Bokashi and EM-1 applied singly or in combination produced more marketable heads due to less rotten heads. The heavier heads of lettuce from Bokashi + EM-1 may be attributed to its compactness and thicker leaves than plants from other treatments.

On potato, application of EM-1 alone or in combination with Bokashi produced shorter plants than those applied with chicken manure + NPK at recommended rate, however, other treatments like NPK at recommended rate, Bokashi alone and NPK at 1/2RR were higher by one to three centimeters only which was not significant. The production of classified tubers from each treatment varies. However, more tubers of excellent sizes (jumbo, extra-large, large and big) were obtained from plots applied with Bokashi + EM-1 than farmer's practice (Fig. 3b). This suggest that Bokashi + EM-1 is better than chicken manure + NPK at RR in providing nutrients to potato plants and therefore produced better sizes of tubers. The increase in yield was due to the efficacy of Bokashi and EM-1 as fertilizer supplementing the necessary nutrients for plant growth. The better performance of Bokashi and EM-1 over the commercial fertilizer was also clearly observed in this

trial. Generally, lower bacterial wilt infection was observed on plots with Bokashi and EM-1 applied singly or combined with inorganic fertilizer.

### **References**

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