Research article

Effects of Pyroligneous Acid to Growth and Yield of Soybeans (*Glycine max*)

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Abstract In the Philippines, there is at present a Soybean Roadmap which has two major components, namely: Organic Soybean Production and Organic Soybean Utilization, Processing and Marketing. This research project compliments the Philippine National Soybean Program by developing appropriate organic technologies especially on its external inputs like fertilizer. The main objective of this research was to find out the effects of pyroligneous acid on the growth and yield of soybeans. Philippine Seed Board Soya 6 (PSB SY6) or commonly called Tiwala 8 is an approved variety for use in the country which was planted in field condition of the university research area in 2 x 2 meter plots. This was four (4) times replicated by using randomized complete block design (RCBD). Coconut shell vinegar (pyroligneous acid) was used in this study. There were three levels of pyroligneous acid being tested: 10%, 20%, and 30% which represented Treatment 1, Treatment 2 and Treatment 3, respectively. Treatment 4 served as the control. Statistical analysis revealed that all treatments had not affected to the growth of the soybean plants. However, it was noted that there was a significant effect of wood vinegar on the yield.

Keywords pyroligneous acid, soybean road map, external inputs

INTRODUCTION

The Philippine government has installed the National Soybean Development program which created the Soybean Roadmap 2010-2014 called "Building Sustainable Soybean Industry in the Philippines". This program will enhance the government's advocacy for sustainable agriculture and therefore achieve food security of the country.

According to Rosie Aquino of the Department of Agriculture-Cagayan Valley Integrated Agricultural Research Center, "farmers will have a benefit from the program in terms of enhanced productivity, improvement of soil fertility, improvement of household nutrition as a result of product consumption that is protein-rich, and income augmentation through utilization of soybean meal for backyard swine raising".

Aquino further emphasized that "The resulting soybean program strives to develop improved soybean varieties that are resistant to biotic and abiotic stresses, and are favorably responsive to organic production management practices," (Go, 2011).

In the province of Bohol, the Department of Agriculture has launched the Soybean Development Program to promote soybean production as source of protein and as a crop that can withstand adverse conditions especially drought as soybean is proven to be resistant to heat stress (Cartagenas, Daisy

personal communication). Several on site trials have been conducted in collaboration with the farmers to determine the best performing varieties for mass production.

One of the challenges in organic agriculture program is the availability of organic inputs for the cultural management of crops. As it is desired to pursue organic soybean production, there is a need to look for effective organic inputs that could positively contribute to the overall performance of the crop as soybeans. In a study on peanut, it was found out that Foliar application of wood vinegar increased vegetative growth and this might result in preventing the sunlight reaching the soil surface under the plant canopy and consequently higher in soil moisture content (Jothiyankoon et al., 2008).

Masaki Yokomori, a senior technical adviser of Japan Agricultural Exchange Council has established a demo farm and introduced the use of Mokusaku (Wood Vinegar) in the vegetable farms of Benguet, Mountain province. Wood vinegar is accepted by vegetable farmers as it has improved the performance of their vegetables (Yokomori, 2011).

As there is also a program on Organic Soybean Production, there is a need for organic inputs as a source of fertilizer and pesticides. Wood vinegar, as proven by other researchers, can be a good source of such organic inputs. Hence, there is a need to do research on this aspect with the hope of validating the usefulness of wood vinegar on the performance of soybeans as a crop for attention in the country as a source of protein and an adaptation to climate change.

METHODOLOGY

A randomized complete design (RCBD) of 2x2 meter plots was installed in the vegetable research area of Bohol Island State University by using soybeans as test crops. Soybeans were planted at the recommended distance by researchers of Department of Agriculture. Seasoned pyroligneous acid (Wood vinegar) from coconut shell was applied at one-week interval after planting at the rate of 10% (T1), 20% (T2) and 30% (T3). T4 served as control. Weekly growth of soybeans was taken and recorded. Yield parameters were taken by treatment and all data were subjected to statistical analysis.

Fig. 1 Research plots laid out in a Randomized Complete Block Design

RESULTS AND DISCUSSION

The study was conducted to evaluate the effectiveness of wood vinegar from coconut shell as organic input in the performance of soybeans. Specifically, it aimed to identify the impacts of wood vinegar on the growth and yield of soybeans and identify the effective level of application of wood vinegar for better performance of soybeans in terms of its growth and yield.

Weekly plant height (cm) of the plants was taken in all treatments as shown in Table 1. It was found out that there was a difference of height in all treatments compared with the Control. However, based on the analysis of variance, it was found that the difference was insignificant in all treatments over the control plots.

Table 1 Plant Height of Soybeans (cm)

Treatments	I	II	III	IV	Total	Mean
T1 - 10% WV	49.58	56.59	47.69	53.32	207.18	51.79
T2 - 20% WV	46.26	48.50	48.08	45.17	188.00	47.00
T3 - 30% WV	53.66	49.73	47.20	49.98	200.58	50.14
T4 - Control	45.62	49.08	48.33	51.35	194.39	48.60

Fig. 2 Soybean plants at the maturity stage (A) and the pods (B) ready for harvest

Yield in dry weight for each treatment was taken as shown in Table 2. Analysis of variance showed that Treatments 1, 2 and 3 were significant over that of Control. This means that all treatments of wood vinegar have a significant effect to the yield of soybeans. Treatment 3 (30% WV) got the highest mean yield of 1.26 (0.315 kg/sq.m. or 3.1 tons/ha), followed by Treatment 2 (20% WV) with the mean yield of 0.97 (0.242 kgs/sq.m. or 2.4 tons/ha) and Treatment 1 (10% WV) got the mean yield of 0.93 (0.232 kgs/sq.m. or 2.3 tons/ha). Treatment 1 and Treatment 2, however, showed no significant difference as to yield. Treatment 4 (no application of WV) got the mean yield of 0.55 (0.1375 kgs/sq.m. or 1.3 tons/ha).

Table 2 Yield of soybeans (kgs)

Treatments	I	II	III	IV	Total	Mean
T1 - 10% WV	0.90	0.88	0.99	0.95	3.72	0.93
T2 - 20% WV	1.00	0.94	0.99	0.95	3.88	0.97
T3 - 30% WV	1.05	1.15	1.56	1.28	5.04	1.26
T4 - Control	0.65	0.35	0.58	0.65	2.23	0.55

Table 3 Analysis of variance on the yield of soybeans

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	5%	1%
Block	.083	3	.028	1.803	.217	3.86	6.99
Treatment	.999	3	.333	21.727	.000		
Error	.138	9	.015				
Corrected Total	1.220	15					

a. R Squared = .887 (Adjusted R Squared = .812)

Fig. 3 Harvested soybean seeds in all treatments

CONCLUSION

Application of Wood Vinegar has no influence on the growth of soybeans based on weekly recorded height of plants. The effect was observed on the yield as all treatments showed the significant difference over its control plots. Plants treated with 10% and 20% wood vinegar showed no significant difference as to its effect on yield. It is concluded that the increased percentage of wood vinegar increased the yield of soybeans.

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REFERENCES

Cartagenas, D. 2015. Central Visayas Integrated Agricultural Research Center. Ubay, Bohol, Philippines. Personal Communication.

Go, M. 2011. http://www.philstar.com/business/648973/da-drafts-5-year-soybean-roadmap

Jothiyangkoon, D.J., Koolachart, R.K., Wanapat, S., Wongkaew, S. and Jogloy, S. 2008. Using wood vinegar in enhancing peanut yield and in controlling the contamination of aflatoxin producing fungus. Department of Plant Science and Agricultural Resources, Khon Kaen University, Thailand and School of Crop Production

Technology, Suranaree University of Technology, Nakhon Ratchasima, Thailand. Retrieved November 10, 2015 from http://www.intlcss.org/files/congress-proceedings/2008-papers/cs3-s6/cs3-s6-o5-daruneejothityangkoon.pdf

Yokomori, M. 2011. Farmers in Benguet practice savers technology. The Japan Agricultural Exchange Council. Rianella Printing Press, Baguio City, Philippines.