

The Benefits of Organic Fertilizer in Soybean Farming

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Abstract: The effect of organo-mineral fertilizer compost as a partial alternative to mineral fertilizers, on soil characteristics, growth, physio-biochemical attributes, Cd² and No₂ concentration and yields of GLYCINE MAX, plant under low soil fertility. Different organic mineral materials were mixed with water composted in a concrete trench of size 4x5x2 meter (W x L x D), respectively. The moisture content was maintained at 50-60 percent throughout the active composting period by frequent checking. The mixture was turned at 7-day intervals for about 2 months to maintain porosity. The organic mineral compost was applied – for acidic soil at the minimum requirement of half sack of compost. In addition, this was only applied as a control to achieve the purpose of this study. Growth characteristics, quantitative and qualitative yield, Cadmium (Cd²) and (No₂) concentration and physiochemical attributes in common leguminous crop like Soybean (Glycine Max). Addition of MF compost improved the soil chemical and physical properties. Application of compost fertilizer at the rate of one half (½) sack as an alternative to 50 percent of the recommended dose mineral fertilizers, significantly decreased the concentration of Cd² and No₃ in plant leaves, pods and seeds, showing the same characteristics. This treatment also improved all determined physio-biochemical attributes and tested soil characteristics compared to control. The benefit of this compost fertilizer, as a partial alternative to chemical fertilizer, demonstrated the validity and possibility of sustainable agronomic performance of common leguminous crops using locally available recycled organic materials. The result of the study shows that the growth development of Soybeans is effected by organic fertilizer (compost) by using ring method, have good growth appearance, performance and an increase in size and other parts of the plant. However, due to some unforeseen things, some at the matured plants appeared to be yellowish and late blooming. The Treatment I, show that the plants to which compost fertilizer was applied from the first to third measurement plant grew better. While Treatment II, the leaves appeared yellowish in color due to some circumstances and may be inappropriate of fertilizer application.

Keywords: cultivation and weeding, depth of planting, fertilization, germination, growth of plants, harvesting, drying and storing, land preparation, methods of planting, occurrence of flowers, pests and diseases and their control, preparation of planting materials, rainfall and weather condition, reaction of plants to the application of fertilization, seed inoculation, seed treatment, time of planting.

1. Introduction

A. Soybean Farming

Soybean is scientifically known as Glycine Max, which belongs to the legume family (Leguminaceae). It is a warm herbaceous annual crops adopted to warm, temperate climate, as can be observed during summer season.

Soybean plant grows vertically; its protrude from along the stem. The extent of balancing depends an environmental condition and or planting rate with average plant height that vary from 3 to 4 feet tall. Depending on cultivar, soybeans are either determinate or indeterminate; later maturity cultivar id indeterminate. Indeterminate types sometimes appeared to be determinate because of the occurrence of short internodes and small axillary's racemes on some actually indeterminate stances.

Soybean is known to have curative, and nutritional factor like the "Trypsin Inhibitor", which obstruct the normal process of protein digestion in animal and human. This anti trypsin factor can be destroyed by heat. Therefore, the soybean for food or feed should be cooked or undergo the heating process before it is to be consumed. It is used to improve soil especially when plowed with green manure. Soybeans has 36 percent protein content, as well as carbohydrates, vitamins and minerals are often lacking in some other seed diets. Soybeans is an important plant intercropping and relay cropping. It enriches the soil with nitrogen because of its symbolic relationship with nitrogen – fixing bacteria. Soybeans grows in many type of soil from clay loam to silky loam soil. For optimum yield, soybeans thrive best in well-drained soil with an average of 5.8 to 6.2.

When grown for seeds, soybean should be planted in such a way that harvesting coincide with the dry months to minimize losses due to too much water, pest and diseases. Crops grown for green manuring may be planted anytime of the year or any type of climate. However, flowering is better during the wet month for it encourages more vegetative growth and hasten the decay of green manure.

Soybean is mainly as an annual hay-crops and is in some instances used as green manure with development of soil extraction method. Soybeans are also produced for commercial purposes. It is used as an inedible oil competing with other vegetable oils, such as cotton seed oil and drying oil in paints and ink, which is valuable. Soybeans meal is a major

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component of meat substitute that is increasingly becoming popular, in China particularly in Thailand. Soybean is a versatile crop they are mainly used as a forage crop and for green manure. The crop is harvested in the form of seeds as “Beans”, which are processed for oil. Soybean oil is used as an edible oil in the production of mayonnaise, margarine, and similar products. The drying reaction of the oil is used in paints, varnished, ink and of course it is also used in specially foods.

Soybean is a life-giving crop, nothing is wasted. The plant itself is being utilized as pasture, forage in the form of ensilage hay and silage. Its beans are utilized as food and raw materials industry, (like soy sauce, mayonnaise and margarine). Everything about it can be consumed as whole, and prepared in variety processed forms, such as beans paste, soy sauce and beverage.

In addition, the immature leaves can also be eaten as a green vegetable. Soybeans plant contained an average of 36 percent pods and seeds vegetable have high amount of thiamine, riboflavin, niacin and other vitamins. Sprouted soybeans are good sources of vitamin C. In looking to the future, soybeans must be considered as crop with great potentials for improving both the quality and the quantity of the human diet.

Because of its broad utility and versatility for both human and animals nutrition there is a worldwide shortage of the crop in Taiwan, Thailand and other part of Asia.

B. Significance of the Study

Importance of the study of soybeans would serve as an income to the farmers and some researcher to propose in planting soybean in our locality.

To study of planting soybean is most effective to the (raiser) is a great challenge to the farmers as well. Therefore, this soybean is a money making product and however, this soybean would serve as a reference for those person who are wanted to engage in planting soybean and it is the needs of the community or for human consumption.

C. Hypothesis

Author revealed has to gain the objective of the study for testing and evaluating the following research hypothesis.

The production and ratio of the land of improving in planting soybean in the Province of Sulu.

Identifying the following organic fertilizer (compost), which is more effective and improve the fertility of the soil and economic crops production which is soybean.

Table 1
Definition of terms

Research	Deep study or investigation using source materials
Fertilizer	Any substance, which is added to soil supply those elements required in the nutrition of the plants.
Compost	A mixture of fertilizing the ground, a mixture that consist largely of decayed organic matter.
Seed	A part of plant that contain embryo of the future plant.
Data	Constitute an accepted number quantity, fact or relation use as basis and for drawing conclusion, reference or carrying out investigation.
Cultivation	The act of tilling the soil in order to destroy the weeds and to facilitate the growth of plant.
Tillage	Mechanical manipulation of soil on a crop production.
Plowing	A primary tillage operation which performed to shatter soil with partial or complete inversion.
Harrowing	A secondary tillage operation, which looser, pulverize smoothness or control weeds.
Furrowing	A tillage a long farming operation using a tools which splits the soil and turn has furrow literally in opposite direction whereby ridge and furrow.
Soybean	Is the most widely grown among the field legume because it is well adapted to the country's soil and climate conditions.
Hilling-up	An operation that open the furrows midway between two rows of land throw the soil toward the base of the plant.
Indeterminate	Description of an inflorescence in which the terminal flowers is last to open. The flower rise from axillary buds, and the floral axis may be indefinitely prolonged by a terminal.
Determinate	Descriptive of an inflorescence in which the terminal flower open first, their arresting the prolongation of the floral axis.
Internodes	An interval or part between two nodes (as of stem).
Raceme	An inflorescence in which flowers and pedicels are born on a simple un-branched main axis.
Cultivar	A cultivate variety within the plant species that differ in some respect from the rest of species.
Forage	Vegetation used as feed for livestock.
Green Manure	A crop that is plowed under which still green and growing to improve the soil.
Dormancy	A period of reduced physiological activity occurring in seeds, buds, etc. resting period.
Silage	Forage that is chemically changed and preserved by fermentation.
Hay	Vegetation that is cut and cured for later use as livestock feeds.
Pod	A dehiscent seed or fruits of a leguminous plant such as soybean and the like.
Bud	A terminal or axillary's structure consisting of a small mass meristematic tissue, covered wholly or in part by overlapping leaves.
Annual	Plant which complete its life cycle and dies within one year.
Dehiscent	Splitting along definite seams at maturity.
Disease	An abnormal condition of sufficient duration to produce market derangement in the structure or activities of an organism or its part.
Germination	The sprouting of the seed, spore, or other reproductive body.
Grain	The fruit of a grass, chiefly cereal grass.
Herbaceous	Describing an herb.
Incomplete flower	A flower which lacks one or more of the four kinds of floral organs.
Internodes	The length of stem between two successive nodes.
Legume	One carpelled fruit splitting along two seams; also, a members of which have such fruits.
Legume	A type of soil consisting of a friable mixture of differing proportion of clay, silt, sand, and organic matter.
Nitrogen-fixing Bacteria	Bacteria which lives in soils or in roots of certain higher plant and which convert atmospheric gaseous nitrogen-fixing bacteria.
Essential Oil	Widely distributed organic compounds in plants which have an oily texture.
Fertilization	The essential feature of sexual reproduction.

D. Scope and Delimitation of the Study

This study is to determine the growth and development of the plants. This experimental lot was conducted from August 4, 2007 and December 2007. At the experimental area of MSU-Sulu, research area: Patikul, Sulu under local soil condition.

E. Objective of the Study

1. To be able to understand the growth of soybeans scientifically known as *Glycine Max*, treated at different rate of organic fertilizer (compost).
2. To determine the effect of organic fertilizer (compost) applied on soybeans plant.
3. To determine the soil of the lot being used on this study.
4. To determine if soybean farming is viable in Sulu.
5. To determine which part in Sulu can soybean be planted with optimum yield.

2. Review of Related Literature

Soybeans plant required high light intensity for vigorous growth. They suffer from shading and competition for light from taller-growing weeds; thus, for highest yield, weed control is essential. Chapman "Crop production, principles and practices" by W.A. Company, 1969, pp. 345, 346.

Depending on local conditions and cultivation, extra care must exercise to use appropriate planting rates and row spacing to prevent self-shading of plants. Soybeans best adapted to areas require between 20 to 30 inches of water either natural precipitation, irrigation, or a combination of the two. Soybeans crop are generally produced in regions where annual is adequate, "especially in Sulu Province particularly in Patikul Municipality the rainfall is adequate".

Seeding is made when the soil is just moist. Seeds of soybeans cannot tolerate dry and hot soil condition. Too wet soil especially when heavy downpour occurs immediately after the seeding operation, may cause seed rot. Lark, et.al. *Crop production, principles and practices*, W.A. Company, 1969, pp 347.

Seeds may be drilled within the furrows or planted in hills by hand or by simple drill implement or planter which is locally available. Depth of planting should be 2 to 5 centimeters.

Furrow spacing and plant population density requirements are dependent on seasons of planting and type of field, either ordinary upland or paddy. Wider spacing and lower plant populations are recommended for the wet season. However, closed spacing and higher plant populations are usually made for the dry season and paddy cultivation. John Milton, "Breeding Field Crops", AVI Publishing Co., WestPoint, 1974, pp. 21-22.

In the later, plants are usually subjected to moisture stress and they do not put up enough vegetative growth. A 50 to 60 centimeters and animals. Wood Frank "Plant Science an Introduction to World Crops", W.A. Freeman Co., San Francisco, 1969-1974, pp. 436-437.

In the case of paddy cultivation, three seed are inserted in a hole punched with a sharp-edged hand tool at the base of the hills of the remaining rice stubble. Where furrows are laid out

on bare ground, seeds are planted in hills or drilled, then covered the soil. Covering the field with rice straw (Termed, "Mulching"), after planting is recommended especially if no irrigation water is to be applied for the rest of growing season. Use only viable seeds for planting. Soybean seeds at ordinary storage losses viability in 3 to 4 months. Robert, et.al. "Plant Science, an Introduction to World Crops", W.A. Freeman Co., 1969-1974, pp. 437.

Soybean production on the other hand is uniquely influenced by changes in day length. Day length fluctuate from 12 to 28 minutes in June to eleven hour 46 minutes in Ilocos Norte. The fluctuation strongly influences the onset of the flowering phase and the extent of vegetative development of the soybean plant. During the long day season when day length when day length is beyond 12 hours, vegetative development is enhanced and maturity period prolonged. When day length becomes progressively shorter than 12 hours beginning in late September, the flowering phase sets in early and further vegetative development including plant height is arrested. Bean yield is drastically reduced, if not coincide with sunny day. Therefore, timing of planting of soybean especially during the dry season is very important. *Phil. Sci. Encyclopedia*, Vol. IV, National Research Council of the Phils., 1984, pp. 92.

Soybeans prepare clay loam to silty loam soil, and prepare light-textured soil, especially in the area of Patikul and some other Municipalities of Sulu. Drainage is important, soil pH should be toward the tolerable ranges of 5.5 to 6.5 alkalinity.

Soybeans can be grown successfully under rice paddy cultivations as rotation crops after rice even without irrigation. In fact, much of the soybean Indonesia and Thailand comes from rice paddy cultivation. But for successful soybean production in the paddy, one or two irrigations may be necessary. The center of production for soybean in the Philippines Davao, and Cotabato.

Soil temperature of 60°F, or above, favor rapid germination and vigorous seeding growth, which essential to successful competition with weeds. However, relatively very warm mid-summer temperature above 90°F or 32°C reduce yields and lower oil quality, if the average temperature will increase from the average requirements. Therefore, it sustained temperature below 75° (2415), during this same period delay flowering. *Ibid.*, pp. 92.

The minimum temperature for effective growth is about 50°F or (10°C). it produce good field in areas with minimum frost free period of 120 days and a mean summer temperature about 70°F (21°C).

Emperor Sheng Nung in 2838 BC, once said: Soybean is one of the oldest cultivated plant in China, at which this time the soybean was regarded s one of the five "Sacred Green" vital to Chinese cultivation. Asian Vegetable Research and Vegetable Center. "Soybean Report for 1975", 1976, Shounuwa, Taiwan, Republic of China.

Soybeans plant applied with organic fertilizer is sufficient to satisfy the requirement for increasing the production and improving its quality thus producing good harvest and continuous supply to the market. Department of Agriculture and Food, "Ways to Profitable Soybeans Growing", National

Production Program, Diliman, Queszon City, 1986.

3. Methodology

A. Materials and Method

This part described the location and duration of the study, material and equipment used, data collection, experimental design and statistical analysis, and variety.

B. Located and Duration of the Study

This study was conducted at the area of the experimental lot of Mindanao State University – Sulu, College of Agriculture at the Municipality of Patikul, which started on August 4, 2007 until its maturity.

C. Materials Used/Instrumentation

The following materials/instrumentation during the whole duration of the study are:

1. 1-meter stick
2. 2 Sprinkler, 1 gallon
3. Native plow
4. 2 Bolos and 2 Scythe
5. 1 Sack of organic fertilizer (compost)
6. Half kilo of soybean seeds
7. One rake
8. 1 notebook
9. Bond paper
10. Madre de cacao
11. Straw
12. Wood column

D. Data Gathering

The data gathered at random both for blocks. Representative plants were measured separately, using inches as unit of measurement.

E. Experimental Design and Statistical Analysis

The data are computed randomized complete block design by using two-way classification.

The following are:

Treatment – With organic fertilizer

Treatment – Without an organic fertilizer

F. Method

The method of study was experimental; the area was measured at 50x50. Prior to the breaking of soil, weeding taken into consideration in the first place. Soil was tilled with the used of plow for 3 times and that was pulverized until it was fine and level.

G. Variety

The variety of soybeans plant, most of the studies maintained that the plant belongs to *Orba*. Orba variety is drought resistant and it can resist even the hottest days, particularly during summer month.

H. Cultivation Requirements

1) Land Preparation

Thorough land preparation, better water retention and weed control are needed for root development. Thus, in planting soybeans, land preparation is very significant and the field should be well drained and well pulverized to attain a preparation for planting. In order to have a well prepared field with good tilt, plowing and harrowing for 3 to 4 times is necessary to acquire a better pulverized soil. Actually, there is no specific rule as to how many plowing and one to two harrowing, some may need more, depending on the types of soil and moisture condition. In any case, plow the field to a deep of at least 16 centimeters.

Good land preparation is important not only in providing good soil bit but as a mean of weeds control. Poor land preparation will result in easily weediness, which can outgrow the seedling.

2) Preparation of Planting Materials

Soybean is generally propagated by seed at the distance recommended. Soybeans seed drill in furrows at any ratio of seeds per linear meter row, and should be covered evenly with soil at 3 to 4 centimeters depth.

3) Time of Planting

Soybeans plant should be forecasted during rainy season or toward the end of the dry season. Soybeans are similar to corn in terms of seasonal planting. Even though sowing of soybean in dry season, at least, it must be supplied with water on the area cultivated, usually the best for planting soybean would be in early May. However, in some places, yield decreases depend on the cultivar.

The best month for Soybean must be in September, November, and December are to be avoided during the strong influence of short photo periods. With irrigation, soybean can be planted in late January or early February. Better quality seed crops of grain legumes are obtained during the dry season planting.

Soybeans are good rotation crops after a maize upland or lowland rice crop grown in the west season.

4) Seed Treatment

Water molds which cause damping-off attack young germinating seedling especially during the wet season or in the rice paddy. To improve germination, vigor, and stand of seedling, seed for planting may be treated with fungicides.

Table 2

Spacing, rate of seeding, population equivalents and seed requirement

Spacing or Drilling Requirement					
Crop	Row (cm)	Hill (cm)	No. of plots linear meter when seed are drilled	Approximate population thousand (plts/ha)	Seed requirement (kg/ha)
Soybean					
Wet	60	–	18.22	300	40
Season	50	–	20.30	400	55
Dry	20	2 plants per hills	–	500	70
season					
Paddy					

Thiran, chloronil, quentozene, and captan mixed at 2.5 to 3g/kg seed can be used.

5) Seed Inoculation

Seed inoculants or culture of bacteria or *rhizobia* which can fix atmospheric N is available commercially from the BS. Important inoculants produced in the USA have been observed to be effective for soybeans under Philippine condition.

The inoculant is spread over the seeds and the bulk thoroughly mixed until individual seed are coated black with inoculants. Seed inoculation is done one hour before actual seedling time.

It is estimated that average nitrogen fixation rate per season is 60, 40, and 45kg/ha for soybean respectively.

Table 3
Chemical composition of raw soybean seeds per 100 grams

Constituents	Soybeans
Calories	400.0
Moisture	10.20%
Protein	35.10g
Fat	17.70g
Carbohydrate	32.00g
Fiber	4.20g
Ash	5.20g
Ca	226.00mg
P	546.00mg
Fe	No data
Na	No data
K	No data
Riboflavin	8.50mg
Thiamin	No data
Niacin	2.20mg
Ascorbic acid	No data
Carotene equivalent	No data

6) Method of Planting

The methods of planting applied are possible through the adoption of the recommended guide that is significant for planting soybeans. Seeds were sown into the constructed furrows in straight line at the rate of 18 seeds per planting is done simultaneously for both method of application. Planting of seeds was prepared to the furrows at the depth of 3 to 4 centimeters and the distance between rows was 60 centimeters apart.

7) Depth of Planting

The recommended and correct process of planting soybeans is the most essential actor for seeds germination. Depth of planting is a crucial part in emergence of plant and it should not be more than four centimeters depth at the furrows constructed.

8) Cultivation and Weeding

The main purpose of cultivation is to suppress the germination and growth of weeds especially during the critical period of the first four weeks of seedling growth. Seedlings develop slowly and cannot shade the weeds out. If weeds abound, they compete heavily in the use of fertilizer nutrients.

Hand hoeing and weeding or passing a shallow cultivator can be done as early as 10 to 15 days from seedling germination. Weeding and cultivation can be repeated as often as necessary until the blooming period.

Other techniques considered as general rule for cultivating the weeds such as dressing, hilling up for soybeans are conducted two weeks after planting. For further control of the

weeds another cultivation is spot weeding should be done if weeds still grow on the area.

9) Pests and Diseases and their Control

The application of insecticide on soybean plant is very essential factor to put into consideration in the prevention of plant pests from inflicting damages. Some of the plant pests that attack soybeans are as follows: cutworms, corn borer, pod borer, leaf folders, and earthworms and stinkbugs.

However, second spray of insecticides is necessary to ensure safety whatever types of plant disease. Most experts in agriculture recommend the proper use of effective insecticides such as *endosulfan, diazinon, carbaryl, monocrotophos, phospamidon, thiodan* and *siven*, also the application of *carbofuran* granule to the area is recommended to ward off insect that are known to be harmful.

10) Fertilization

The application of organic fertilizer (compost) is vital for growth development and it can add more nutrients to support the requirement needed by the plants. Soybeans treated with organic fertilizer tend to increase in size rapidly. The leaves will turn to green in color and as expected it will produce good yield.

The organic fertilizer (compost) is applied just before and after deeding – along the bottom of the furrows then covered with 5 to 8 centimeters depth of soil to avoid direct contact with seeds.

11) Harvesting, Drying and Storing

Soybeans plant is ready for harvest when the fruits are fully matured in such a way that 95 percent of its leaves dropped off the stem. Soybeans plant is harvested by the use of modified rice and sorghum thresher or by using a knife. Soybeans fruits require 2 to 3 days period of sun drying until the moisture contained is reduced to 13 percent. When dried, commercial grains should be put into clean sack, then store them in a well-ventilated place.

I. Observation

1) Germination

The soybeans plant germinates after five to seven days. And it can be noted that about ninety percent to the seeds had germinated already. But due to the attacked of the insects, the soybeans did not grow uniformly in size.

2) Growth of Plants

The plants did not grow uniformly after two weeks on both treatments. In treatment number one plants are more vigorous than that of treatment number, and the leaves are greenish in color, this might be due to the effect of organic fertilizer (compost), and watering. Not like in treatment number two where the leaves appeared yellowish in color due to lack of nutrients.

3) Reactions of Plants to the Application of Fertilizer

One week after the application of fertilizer (compost), the plants looked vigorously due to the effect of organic fertilizer applied.

4) Occurrence of Flowers

The occurrence of flowers happened at aged of 34 days after planting. Also, it was found out that the plants to which organic fertilizer was applied on the basis of ring method were the first

to bear flowers as the rest followed.

5) *Rainfall and Weather Condition*

Soybeans plant does not require too much water. It barely needs annual rainfall to supplement and maintain the growth and development of the growing plant. Actually, the right method for watering the plant should be 20 to 30 inches of water either natural precipitation, irrigation or a combination of the two.

Plants cannot resist when there is too much moist. Soybeans plant requires high light intensity for its vigorous growth, and is adopted to areas that have few cloudy day during summer. A suitable climate for soybean is one with distinct dry or wet season.

4. Results, Discussions and Conclusion

This study was conducted last August 4, 2007 at MSU-Sulu, Patikul, Sulu. The total area cultivated was 50x50 square meters, which the soil was thoroughly pulverized; in order the seeds planted could easily germinate. After harrowing the area automatically furrowing followed and planting of soybean is done. The seeds were sown at the amount of 18 seeds per linear meter row. Four days after planting, the seeds began to germinate and within seven days the seeds totally germinated. The plants were often watered with the help of rainfall, but care was observed as not to cause water logging of the soil. Soybeans seedling has an assurance of good growth and the development of plant would highly increase in size.

The week after sowing, proper weeding was done within soybeans row. To prevent damage of the roots, careful and shallow tillage were made. On the same day, the application of fertilizer (compost) ring method was done at any amount.

One month after sowing of seeds, the first measurement was done for every treatment.

It was found out that the highest growth of soybeans plant are those with applied fertilizer, and those that were not have smaller size and height.

The first application of insecticide was considered. Plants were sprayed with *siven* and *thiodan* to prevent insects and fungi attack, the plants were very healthy. Four days after the

application of chemical, it was found out that the plant to which compost fertilizer was applied on the basis of the ring method were the first to bear flower, those that were not, its flowering delayed.

On the forty-five-day from sowing the seeds, the growth development of plants applied with fertilizer using ring method obtained the highest in height. The appearance, size and color of the foliage turned to be dark green, and it was due to the fertilizer added to the soil. The result of the control was still lowest in performance of growth and the leaves become yellowish, due to the absence of nitrogen.

Fifty days after planting, the second measurement was done for every treatment of soybean plant. The height of soybeans to which ring method was applied is still a little bit higher than the control, whereas, the control plant was still in the lowest in height.

The average height of soybeans for one-month interval expressed in inches is shown in table one obtained a highest computed and development.

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