Fungicidal effects of organic soil amendments on some Fungi diseases and yield of soybean *(glycine max)*

G.O. Ihejirika, M.I. Nwufo, and C. A. Amaechi.

DEPARTMENT OF CROP SCIENCE AND TECHNOLOGY,
FEDERAL UNIVERSITY OF TECHNOLOGY, PMB 1526, OWERRI. NIGERIA.
ihegab@yahoo.com

Abstract : Effect of organic soil amendment on some fungi disease and research farm, federal University of Technology Owerri, (FUTO) during the 2007 cropping season. FUTO is located 5^0 27^1 North and $7^0 02^1$ East with an altitude of 90.91m. The result of the experiment showed that cow dung performed best when compared to pig dung not only in the agronomic characters analyzed but also in the areas of diseases severity in all the seasons investigated. Local variety showed least susceptibility to leaf spot disease (7.78%) while Max 34 showed more susceptibility (8.89%) at 4 weeks after planting and cow dung (11.99%) was lowest. There was significant difference in rust disease severity at 8 weeks after planting at 5% probability level. The interaction of local variety and cow dung treated plots recorded lowest disease severity while highest diseases severity was on the control treated plots with max 32. Max 34 performed best in the reduction of the severity of all the diseases investigated. Blight disease was the highest in control (15.67%) but lowest yield when pig dung (12.33%) recorded lowest blight severity among the varieties of soybean used but high yield tons/ha. Among the treatment combinations control x Max 32 recorded the highest disease severity (30.33%) while cow dung x Max 34 had the lowest severity (13.67%) as well as highest yield tons/ha.

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Introduction

Soybean **(***Glycine max***)** is an importance crop of oriental origin which belongs to the family of *Legumineaceae*. However is has been rightly observed that custom is among the limiting factors that prevent people from adopting new crops of food quickly. Soybean belongs to the *Papilionceae* flower or to leguminous plants and may reach a height of 80-100cm the flowers are red; white but can also be violet. The beans grow in pods that develop in clusters of 3-5cm with each pod usually containing 2 or 3 bean. Soybean meal is rich in mineral particularly Ca, P, and Fe also it is an excellent content of vitamins, theamine, miacine and riboflawin. It has protein content of about 39 – 40%, oil 18 – 20%, carbohydrate 25%, ash 48% all these maked soybean meal sophisticated in terms of nourishment inhuman and animal nutrition.

Soy-based materials are gaining popularity in the construction industry. These include Soy-Based candle, soy carryons, Soy fiber (soy silk) used for clothing and for cuddly new toy called "Tofu Bear", Soy-based furniture and foam made from soy can be used for armrests and chair and sofa cushions. Soy-based products are used in car and truck seats, lubricants and Hydraulic fluids, paints and coating, pesticides and herbicides, plastics-soy resins for fiber glass for farm equipment, cars and boat, printing inks, grease, paint oil and stains as well as toner for use in laser printer copier and fax machines. [*http//wwwi/soy.org/soybean-uses/new use*)

Soybean production is hampered by the menace of pests and diseases. Such diseases include: Soybean bacteria Blight, Soybean Brown Spot, Soybean Rust, Soybean Pod and Stem Blight as well as Downy mildew. Soybean Rust is a serious foliage disease that has the potential to cause significant soybean yield losses. It was first reported on the Eastern hemisphere in the early 1900's. It is now accepted that there are tow different fungal species *(Phakopsoral pachyrhizi* and *Phakopsora merbomiac*) that cause Soybean rust. This disease is usually found on the lower leaves of plant especially at or near flowering. As the soybean plant mature lesions may be found in the middle and upper canopy. When conditions are favorable for disease development, yellowing of the foliage may be evident and defoliation and premature death of plant may occur under ideal conditions. The disease can be developed on much younger plant.

Loam soil with pH of 6.0-6.5 is more suitable for the cultivation of soybean but the field should be well drained. Organic amendment Comes from something that is or was alive it includes woodchips, grass Clippings, Straw, compost manure saw dust etc. These increases the soil organic matter content and offers many benefit to the soil such as improving soil aeration, water infiltration and both

water and nutrients and acts as an organic fertilizer fungi and earthworms that live in the soil. (Daivs, 2008*).*Organic amendment has an environmental friendly alternative to conversional agriculture. Bidinga *et.al*, (1996) and her CoIIeagues found out that synthetic chemical produce more adverse environment effect that organic manure.

Organic farming uses organic manures which are basically waste materials such as decomposed animal dung, farm yard manure (FYM) oil cakes, animals bone crush etc. which are natural source of major plant nutrient like Nitrogen (N), Phosphorus (P), Potassium (K). The advantages of using organic manure include the release of plant nutrient slowly for steady uptake by plant, Preservation of the quality of soil to bear the plant on sustainable bases as well as provision of proper aeration and food for the useful soil microbes such as bacteria and fungi which assist the plant to prepare and assimilate food.
[*htt;//www.garyjones.org/mt/archives/00028.htmI]*

Because soybean nodules may not completely cease functioning in manure soil, the best management practice for manure application is to apply less than half of the soybean nitrogen removal rate. Thus will make it less likely that end of season soil nitrate levels are elevated and that nitrate will leach below the root zone (Giller, *et.al.,, 1997)*

A suitable environment can usually be selected for this yield potential to be realized. Soybean however must be planted at the optimum period, correctly fertilized adequately weeded and properly harvested. In production of soybean, cultural and environmental factors have a fare greater influence on field yield than to genetic ones. Soybean is a tolerance of a wide range of soil conditions. *(*FAS, *1986).*

Soybean seed production and distribution is also a major problem of soybean in growing countries of Africa.

Disease such as rust, red leaf blotch, *forg-eye* leaf Spot, bacteria *pastule*, bacteria blight and soybean mosaic virus and also insect Pest, pond sucking and defoliator insects are also among constraint to soybean production. Soybean pest contributes to the so-60 yield loss in soybean production. Some of such serious pests are bean fly, Pod bores, tink bugs, while diseases include: brown spot, soybean pod and stem blight pathogen (*Diaporthe phaseolorum var sojae* and *phomopsis),* soybean bacteria blight *syringal* pv. *glycinea*, soybean *downy midew* (*Peronospora manshurica) Soleretiana* stem rot(*phialophara gregate),* Charcoal Rot (*macrophomina phasedina),*Nematode (*Heterodera glycine),* Soybean Bud blight: pathogen: tobacco spot virus and soybean mosaic: pathogen Virus soybean mosaic virus. One major control of these diseases is by the use of resistance varieties. *[Karenandgail, 2007)*

Soybean rust first reported on Eastern Hemisphere in the early 1900s. It is now accepted that there are two different fungal species, *Phakopsora*, *pachyrhizi* and *Phakopsora meibommae*, cause soybean rust. Soybean rust (*Phakopsora pachyrhizi*) particularly is the most destructive foliar disease of soybean in recent virus and can cause 80-60% yield loss. It is a major disease worldwide. These diseases were first reported in 1998 in Canadia and Zimbabive and in 1999 its existence was reported in Nigeria, Cameron and Bennin Republic *(www.iita.org/ems/details/soybean).*

Soybean rust has the potential to reduce yields significantly, to increase cost of production and reduce profits.

Hence the objectives of this research are to determine the organic soil amendment on soybean rust, to assess the protective capability of soil amendment with varietal differences and to investigate the effect of organic manure on the yield of soybean varieties.

Materials and Methods

The site was normally cleared and was allowed to dry. The dried matters were packed and removed from the site and the field was further marked out 7m by 20.5m and divided into three (3) blocks with a sub plot gap of 0.3m and main plot gap of 0.5m with the plots each measuring $4m^2$ x 9 = 27 plots.

The test crop used was three (3) varieties of soybean namely Max32, max34 and local variety. The soybean varieties treatment "A" and the organic soil amendment treatment "B". Soybean varieties Max32 and Max 34 were obtained from Imo State Polytechnics, Umuagwo while the local variety was obtained from Owerri main market

Treatment A – organic manure (3), which include Pig dung, Cow dung and

No dung (control).The experiment was laid out in a Randomized Complete Block Design at three replications.

Data Collection

The following parameters were measure during the experiment

Diseases severity such as Leaf spot, blight and soybean rust and yield.

Disease severity:

This severity or leafspot, blight and soybean rust was recorded using visual observation and scoring according to the following format.

DISEASE SEVERITY ESTIMATION	SCALE	INTERPRETATION
0	0	No infection
1-20	1	Slightly infected
21-40	2	Moderately infected
41-60	3	Highly infected
61-80	4	Extensively infected
81-100	5	Leaves completely infected

Culture, Isolation and Identification of Organisms

The medium was prepared and the liquid was poured into each of the plates and allowed to solidify. An inoculating needle was used to pick part of each growth and streaked on the surface of the medium (potato dashes agar medium). The inoculating needle was sterilized after each inoculation by rising in ethanol. Each of the microbial growth were inoculated into each plate and left for about 48hours for proper growth and identification.

The microorganism identified with the aid of a microscope. A small part of the microbial growth was picked with an inoculating needle and placed on the side which contains a drop of lacto phenol and covered with a slip and mounted on the microscope.

The microscope was adjusted for proper viewing and they were matched and compared with recommended reference manual and the organism were identified using Barnett and Hunter, (1998). The organisms identified were *Cercospora* species, *Penicillium* and *Fusarium species.*

Results:

The result of soil analysis of the experimental plot showed that Sand was 89.0%, Silt 5.6%, Clay 6.4% and the Textural class was Sandy loam, organic matter 1.27%, organic carbon 0.47%, while total nitrogen was 0.12%, CEC 1.23 while base saturation was 64.2%.

The leaf spot disease was shown to be highest in control treated plots (10.78%) among the various organic manure used while the least was cow dung at 4 weeks after planting.

Among the various soybean varieties used local variety show least susceptibility to the leaf spot disease (7.78%) while Max 34 shows more susceptibility (8.89%) at 4 weeks after planting (Table 1).

Among the treatment interaction/combination, cow dung x local variety recorded the lowest severity of leaf spot disease (8.33%) while control x Max 32 interaction shows more susceptibility to the leaf spot disease (13.67%). At 4 weeks after planting there was however no significant difference ($p = 0.05$) between the organic manure types, the varieties as well as the treatment combinations (Table 1).

All the infection recorded low severity of leaf spot disease at 8 weeks after planting. Leaf spot severity was highest in controlling treated plots (15.22%) and lowest in cow dung (11.99%).

Among the soybean varieties used, Max 32 was highly susceptibility (14.11%) while local variety show the least (11.56%) . among the treatment combination, control X Max 32 shows the highest susceptibility among all the interaction (17.67%) while cow dung x local variety show the least of susceptibility (10.33%).

At 12 weeks after planting, leaf spot was highest in control treated plots (20.11%) and least in cow dung treated plots (14.11%). Among the soybean varieties used Max 32 and local variety showed less susceptible to the spot disease (16.33%, 13.00%) than Max 32 which appeared more susceptible (18.11%).

Among the treatment interactions, control x Max 32 and pig dung x local varieties where more susceptible (19.33%) respectively while cow dung x Max 34 showed less susceptibility (14.60%) as shown in Table 1.

There was however no significant difference ($p = 0.05$) among the organic soil amendment types, the soybean varieties as well as the treatment interaction.

The rust disease was shown to be highest in control treated plots (2.78%) and lowest in pig dung plots (1.56%). Among the soybean varieties Max 32 showed more susceptibility (2.22%) while local variety showed least susceptibility (1.89%). Among the treatment interactions, control x Max 32 showed highest susceptibility among all the treatment interactions (3.33%) while cow dung x local variety showed least susceptibility (1.00%) at 4 weeks after planting (Table 2).

There was no significant difference ($p =0.05$) among the organic manure types, the soybean varieties as well as among the treatment interactions.

At 8 weeks after planting, the result obtained shows that control treated plots were more susceptible to the rust disease (11.44%) and the least susceptible was the cow dung plots with (9.56%). Among the soybean varieties Max 32 and Max 34 were susceptible to the rust disease (10.11%, 10.11) and the least susceptible was the local variety (9.89%).

The treatment interaction with the highest level of infection was the control pig dung x Max 32 x Max 34 (13.00%) and the least susceptible is the control plots x local variety and cow dung x local variety (8.00% , 8.00%) as shown in Table 2.

However there was no significant difference among the organic soil amendment types.

At 12 weeks after planting, the result obtained shows that control treated plots had more rust severity (16.00, 14.78%) while cow dung had the least severity (12.66%, 12.78%). Among the varieties of soybean, Max 34 recorded more disease severity (14.45, 14%) while local variety had the least severity (12.00%)

The blight disease was the highest in control (15.67%) and lowest in pig dung (12.33%) among the varieties of soybean used at 4 weeks after planting, Max 32 had the highest blight infection (12.33%) while local variety had the least severity (10.78%). Among the treatment interaction Control x Max 32 experienced the highest blight severity (17.00%) while cow dung x local varieties had the least (7.64%). Control treated plots had the highest severity of blight (15.55) while cow dung had the least severity (13.22%). Local variety recorded the lowest disease severity (12.11%) while Max 32 recorded the highest (13.99%). Among the treatment combination, blight disease was the highest in control (15.67%) and lowest in pig dung (12.33%) among the varieties of soybean used). At 12 weeks after planting, local variety had the lowest disease severity (17.55%) while control had the highest severity (27.78%). Among the treatment combinations control x Max 32 recorded the highest disease severity (30.33%) while cow dung x Max 34 had the lowest severity (13.67%) as well as highest yield in tons/ha (Table 3).

Discussion

An experiment on the effect of organic soil amendment on some fungi diseases and yield of soybean was carried out in 2007 and 2008 cropping seasons at school of Agriculture and Agricultural Technology experimental Farm, Federal University of Technology Owerri.

The soil was analyzed for its physical and chemical properties and was found to be slightly acidic with pH of 5.84 and 5.12 using H_2O and KCl respectively as extractants. The soil was found to be porous due to high percentage of sand (89%) silt and clay which has properties that encourage moisture retention were rather low 5.6% and 6.4% respectively.

The soil was also low in organic mater content (1.27%) in Nitrogen content (0.12%) and in exchangeable cation. These makes the soil nutrient status so poor and this confirms the result of research above by Ohiri, (1992) who reported that the soil in Imo, Rivers, Abia, Akwa Ibom area characterized by low pH, low organic matter and low exchangeable cations.

This low nutrient status implies that for effective and good yield of arable crops such as soybean etc, external source of nutrient supply is to be added to boost crop yield.

This consistent performance by cow dung can be attributed to endowment of the cow dung with the basic soil nutrients and this superiority of cow dung over pig dung was confirmed by Hesieh, (1999*)* as well as Moynard, (1999*)*. Cow dung also showed superiority in disease severity on the experimental site, it showed less severity of the leaf spot, rust and blight disease than the pig dung as a soil amendment.

Control plots however showed more severity of the diseases. This result therefore suggests that cow dung although added high amount of nutrient in the soil, the soil does not contain great microbial load as much as pig dung contained. Max 34 performed best in plant height, in number of seeds per pod, number of pod per plant and yield in kg/ha. Max 34 performed best than others.

This overwhelming performance by Max 34 variety can be attributed mainly to its genetic make up, not just the soil amendment received and this however, supports the assertion by Kang, *(1998)* that the genetic constitution of a crop genotype does not change from one environment to another, unless the environment includes the changes or mutation.

Furthermore among the varieties of soybean used, local variety however showed it's superiority in the aspect of resistance of these various diseases observed in the experimental site seconded by Max 34 which is prone to the disease in question. These results clearly indicate that the genetic constituent of plant determines its phenotypic performance Buhler and Gunsolus, *(1996).* Also, among the treatment interactions used, cow dung and Max 34 had the best performance in 2007 and 2008 respectively. These performance of cow dung x Max 34 can be attributed to the strong genetic constituent of Max 34 and high nutrient composition of the cow dung which makes it a strong combination.

Table 1. Interactive effects of Leafspot disease at different time of plant age

Treatments	Weeks After Planting 4	8	12
0_1 (Control)	10.78	15.22	20.11
2	8.09	11.99	14.11
3	8.33	12.22	16.11
$LSD_{0.05}$	2.52	4.69	4.05
V_1 (Max 32)	8.89	14.11	18.11
V_2 (Max 34)	8.56	13.69	16.33
V_3 (Local V)	7.78	11.56	13.00
$LSD_{0.05}$	2.52	4.69	4.05
0_1V_1	13.67	17.67	19.33
0_1V_2	10.67	15.67	16.33
0_1V_3	9.00	14.01	15.67
0_2V_1	9.67	13.33	18.21
0_2V_2	9.67	15.33	18.00
0_2V_3	8.33	10.33	14.61
0_3V_1	9.33	14.33	16.67
0_3V_2	10.33	15.21	18.33
0_3V_3	9.50	14.33	13.31

Table 2. Interactive effects of Rust disease at different time of plant age

Weeks After Planting 4	8	12
11.44	14.78	15.67
9.56	12.78	13.44
10.56	13.22	12.33
2.04	1.67	4.39
10.11	14.45	12.33
10.11	13.6	11.33
9.89	12.11	10.78
2.04	1.63	4.39
13.33	16.11	17
9.00	13.31	5.33
8.00	13.33	7.67
11.33	14.67	15.33
9.33	14.33	12.38
8.02	12.66	7.67
10.67	13.67	14.67
13.02	14.67	16.33
10.00	11.00	14.30

Key:
O_1 = Control, O_2 = Cow dung, O_3 = Pig dung
V_1 = Max 32, V_2 = Max 34, V_3 = Local variety

Table 3. Interactive effects of Blight disease at different time of plant age and Yield tons/ha

Treatments	**Weeks After Planting**			**Yield tons/ha**
	4	**8**	**12**	**463.89**
0_1(Control)	15.67	15.33	27.78	3458.33
0_2	13.44	13.77	17.00	2958.33
0_3	12.33	13.22	17.55	4626.61
$LSD_{0.05}$	**4.39**	**4.54**	**8.84**	**2669.44**
V_1 (Max 32)	12.33	13.99	21.55	2802.78
V_2 (Max 34)	11.33	13.67	19.00	1530.56

V_3 (Local V)	10.78	12.11	18.78	462.61
LSD $_{0.05}$	**4.39**	**4.54**	**8.84**	**3658.33**
0_1V_1	17.00	17.33	30.33	3475.05
0_1V_2	5.33	12.00	14.67	3241.67
$01V_3$	7.67	11.33	14.33	1700.33
0_2V_1	15.33	10.33	14.00	3433.33
0_2V_2	12.38	8.33	13.67	1708.33
0_2V_3	7.67	10.33	19.33	916.67
0_3V_1	14.67	15.33	29.33	220.25
0_3V_2	16.33	13.67	23.00	233.33
0_3V_3	13.00	14.67	29.33	241.67

Conclusion

Cow dung performed best in diseases severity reduction and yield. Also Max 34 performed best in disease resistance and yield, while the Local variety showed more superiority in the area of disease resistance and yield. Cow dung x Max 34 interaction proved to be best among other treatment combinations on the reduction of field disease development and yield of soybean.

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