Influence Of Digests (Fertilizers) On Certain Parameters Agronomic And Biochemical Of Beans (Phaseolus Vulgaris l.) In Faranah (Republic Of Guinea)

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Abstract: The results of this study, the vegetative cycle of the bean (Phaseolus vulgaris L.) ranges from 60 to 65 days, the average height of the plants (45 cm). The digestate of Dinguiraye as a fertilizer on the number of pods by plant (23.45), followed respectively by Dabola and Faranah is 22.30 and 16.60. The number of control pods is 17.25 which is close to the average of the four values of 19.90. Faranah (3.65), Dinguiraye (3.55), Dabola (3.40) and control (2.75), with an average of 3.34 seeds per pod. Dabola digestate provided the largest weight of 1000 seeds compared to Faranah digestate at 546 g and 382 g, respectively, and the other digests gave intermediate values, with an average of 423.5. The high yield was provided by the Dinguiraye digestate (2.01 t/ha). That of Dabola (1.98 t/ha). The control gave a lower yield of 1.43 t/ha. Moisture content in the seeds grown according to the origin of the fertilizers (digests) have a value of 7.77% for Dalaba to 8.38% for Dinguiraye, with an average of 8,09%. The dry matter levels are relatively equal for an average of 91.92%. Protein levels ranged from 12.80% for the control to 15.40% for Dinguiraye, the overall average is 14.32%. The fat and mineral levels are respectively 2.91% to 3.70% and 3.43% to 3.85%, with the following materials: fat (3.12%) and mineral matter (3%). 65%). The crude fiber levels are relatively close, with an average of 16.30%. This experimental study on the use of different digestive states (Faranah, Dabola and Dinguiraye) is like a soil amendment, influenced by some agronomic and biochemical parameters of the bean (Phaseolus vulgaris L.).

Key words: Influence, digestate, agronomic, biochemical, bean.

1. INTRODUCTION

The bean belongs to the family Fabaceae, the genus Phaseolus and the vulgaris species. The bean (Phaseolus vulgaris L.) has a chromosome number equal to 2n = 22 (Gepts P., 1990). The bean or Phaseolus vulgaris L. was identified by Linnaeus in 1753. It is a fruit of a plant native to Central and South America. About 7000 years ago, beans were grown by Indian tribes as well as in Peru. Beans and their cultivation spread to Africa, Asia and Europe in the early 17th century thanks to Spanish and Portuguese explorers. In Europe, this plant was first grown for these grains, the fresh bean was only consumed from the end of the 19th century in Italy. According to some studies, in 2011, the average yield of beans in the United States was about 2.93 MT/ha. Currently, there are more than 100 species of beans of varying shape, color, flavor and nutritional value (CNSA/MARNDR, 2012). The bean seeds germinate between 4 to 8 days for temperatures between 12 and 35°C. The trifoliate leaves appear 6 days after emergence. Flowering begins 3 weeks to 1 month after sowing, it is spread over 1 month to 1 month and a half, the young pod takes a dozen days to reach its final size. The seeds are formed in 15 to 20 days, it is necessary to wait another month for them to reach complete maturity. Growth is rapid only above 12 to 13°C for dwarf varieties and 14 to 15°C for row varieties. The cultivation of the bean needs 300 to 400 mm of water, regularly distributed, with a critical period at the beginning of flowering (Graham p. H. 1980). The bean prefers light, deep and healthy soils. Heavy soils are to be avoided as well as stagnant moisture bottoms unless sown on ridges. It adapts to slightly acidic soils, with a pH ranging from 6 to 7 but its development remains correct up to a pH of 4.7 (Ralaidovy h. V., 2004). Beans are best known for their high protein content (25 to 28%). In our day beans are eaten mainly in underdeveloped or developing countries (Daniel C., 2016 and Missihoun et al., 2017). In 2000, world average dry bean consumption was estimated at 2.2 kg per capita per year, with strong variations across continents: Latin America (9.4 kg), North America (5.5 kg), Africa (2.2 kg), Asia (1.3 kg), Europe (0.7 kg). In some Third World countries where beans are a staple, consumption can be very high: up to 55 kg / year in Rwanda and 66 kg/year in western Kenya (Portail de la botanique 2008). Thus, just like the energy recovery of biogas, the question of the valorization of the digestate must be systematically part of every methanisation project, the anaerobic digestion can indeed be an agronomic tool that it is necessary to know how to use correctly to draw all the benefits In fact, biogas digestates may have a dual agronomic interest: contributing to soil carbon stock and making mineral elements (N and P) available to plants (Möller K., 2015). Nevertheless, this agronomic interest is potentially accompanied by environmental impacts that must be minimized: loss of fertilization value by ammoniacal volatilization, nitrate leaching and greenhouse gas emissions such as N_2O and CH_4 (Cavalli D. et al., 2017) It is very difficult to distinguish the effects of a contribution of organic matter, methanised or not, on soils. Many factors are at play, and often past practices are poorly characterized, making any extrapolation complex. In addition, the comparisons between treatments are often made in raw material equivalent or nitrogen supply, thus not taking into account the possible mass losses in other elements, for example carbon, again making interpretation difficult (Couturier C., 2014). In general, it is observed in many cases that the anaerobic digestion plays a beneficial role both on the physical properties and on the biological properties of the soils: increase of the respirometric activity, the nitrifying activity of the micro-organisms, the biomass bacterial, enzymatic activity, cation exchange capacity, increased abundance of earthworms (Odlare M, et al., 2008 and Wentzel S. et al., 2015) Guinean agriculture is largely dominated by family-type farms, which constitute almost all village agricultural activities. These holdings cover about 60% of the population and occupy about 95% of the country's agricultural land. This type of farm, generally of modest size (0.30 to 0.50 ha) in which production and consumption closely interrelate, is in fact very varied in form, determined by their agricultural situation and their availability in factors of production. Rainfed crops are predominant and represent 95% of the total areas developed. The areas under irrigated crops are insignificant. Of the rainfed crops, over 40% are on hills or mountains and 30% on plateaus. The lowlands and mangroves are poorly exploited. In Guinea, farmers are benefiting from favorable agroclimatic conditions for growing beans in three of the four regions in the country. Today, beans represent a diversified sector for agricultural export products. According to the Agricultural Research Institute of Guinea (IRAG), the first experiments in bean production date back to 1988 with technical and financial support from the Loire-Atlantique department in France. A 2011 study by the United States Agency for International Development estimated that national bean production is around 100 tons per year, of which almost 70% is exported, mainly to the European market. The production of beans follows a short growth cycle. It usually takes 45 to 50 days from sowing to harvest. This theoretical cycle is strongly influenced by the often-variable temperatures. The marketing system is relatively short, the green beans are generally produced in peri-urban areas, and sold in the large urban markets of Kindia (Lower Guinea), Kankan (Upper Guinea), Labe (Middle Guinea) and in the major markets. hotels in Conakry, the capital. However, prices vary according to the quality of the product (Groupe Energies Renouvelables, Environnement et Solidarités, 2018). Guinea's agriculture is very vulnerable, it mobilizes the potential offered by natural resources. The ecological equilibrium which made it possible to maintain the soil fertility is broken in multiple situations on the one hand under the action of the men confronted with increasing densities and on the other hand under the absence of a control of the water. Much of the land is facing a sharp decline in fertility or even forms of aridification. Hence the main objective of this study, which consists in upgrading the digestates of anaerobic digestion as part of the soil amendment for the cultivation of cereals such as beans, in the region of Faranah (Ministère de l'Agriculture, de l'Elevage, de l'Environnement et des Eaux et Forêts, 2015).

2. MATERIAL AND METHODS

2.0 Presentation of the study area

The Faranah Administrative Region is the central part of Guinean territory which represents the transition zone between Middle Guinea, Upper Guinea and Forest Guinea. It is located at 8°50 and 12° North Latitude and 9°15 and 11° 29 West Longitude. It includes four prefectures: Dabola, Dinguiraye, Faranah and Kissidougou subdivided. The climate as a whole is Sudano Guinean type with the alternation of two seasons: dry and rainy. The average annual rainfall varies between 1200 mm and 2300 mm from north to south. The average annual temperature is 27°C (Ibrahima BARRY et al., 2019). The study was carried out in the experimental field of the Agriculture Department of the Higher Agronomic and Veterinary Institute of Faranah. The digests used for this experimental study come from the methanation sites of three (3) prefectures of the Faranah administrative region (Dabola, Dinguiraye and Faranah). See figure 1.

Origin of digestates and study area

Geographic Location Map Faranah Region of Guinea

Figure 1: *Map of the study area*

2.1 Methods

The methodology for this study is as follows:

- Soil and digestate analyzes: the physicochemical and agrochemical analyze of the digestates and the soil of experimentation were carried out in the laboratories of Pedology and Chemistry of Soils of the Higher Agronomic and Veterinary Institute of Faranah, in the National Service of Soils of Guinea, the Center for Environmental Studies and Research Conakry and the Diagnostic and Veterinary Center of Conakry (Ibrahima BARRY et al., 2019).
- Soil preparation: it consisted in cleaning the plot used, the plowing of 10 to 15 cm of soil depth, the mixture of digestate with plowed soil, for a dose of 12.5 tons of digestate per hectare.
- Seedling: The bean (Phaseolus vulgaris) of the dwarf variety GPL 190 in white color was used. Sowing was done 15 days after the preparation of the soil, we sow in rows spaced 30 to 40 cm at a rate of 25 to 30 seeds per meter. Staking took place when the plants reached 15 to 20 cm tall before flowering.
- Maintenance: We did weed followed by ridging when the plants had 4 leaves to facilitate rooting, slow erosion and control of bean maggot.
- Harvesting: The harvest takes place 2 months after sowing. After harvest biochemical analyzes of the bean seeds were done in the laboratory.

The steps of this experimental study are mentioned in figure 2.


Picture 1: Preparation of the experimental soil


Picture 2: Preparation of the experimental soil


Picture 3: 15 days after semi


Picture 4: Bloom, 40 days after semi


Picture 5: Beginning Fruiting


Picture 6: Bean seeds after drying

Figure 2: *Experimental steps*

3. RESULTS AND DISCUSSION

The results obtained during this study are presented in tables 1 and 2.

3.0 Results

Table 1: Agronomic characteristics of cultivated beans

Agronomic characteristics	Witness	Origins of digestates			Average
		Faranah	Dabola	Dinguiraye	
NMGP	17.25	16.60	22.30	23.45	19.9
NMGG	2.75	3.65	3.40	3.55	3.34
PG_{1000} (g)	383	382	546	383	423.5
R (t/ha)	1.43	1.73	1.98	2.01	1.79

NMGP: Average number of pods per plant, NMGG: Average Number of Seeds per Pod, PG1000: Weight of 1000 seeds, R: Yield (t/ha)

Table 2: Biochemical characteristics of bean seeds

Origins of digestates	Biochemical characteristics (%)					
	Humidity	Dry matter	Protein	Fat matter	Mineral matter	Crude cellulose
Witness	8.12	91.88	12.80	2.91	3.43	15.40
Faranah	8.10	91.99	15.00	3.01	3.85	17.90
Dabola	7.77	92.23	14.10	3.70	3.70	16.90
Dinguiraye	8.38	91.62	15.40	3.23	3.64	16.20
Average	8.09	91.93	14.32	3.21	3.65	16.60

For a good interpretation and discussion, the results obtained are represented on diagrams below.

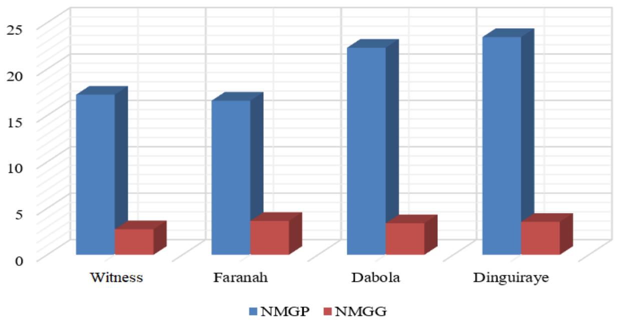

Figure 3: *Diagram of average numbers of pods per plant (NMGP) and seeds per pod (NMGG).*

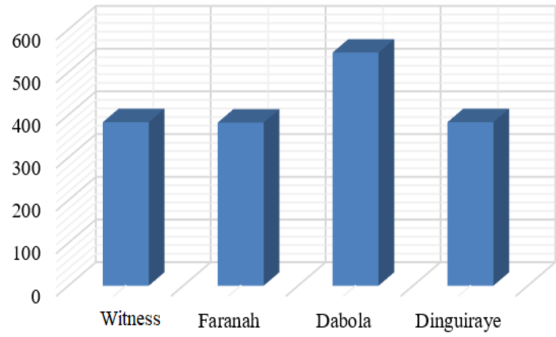

Figure 4: *Diagram of the weights of 1000 seeds for each prefecture*

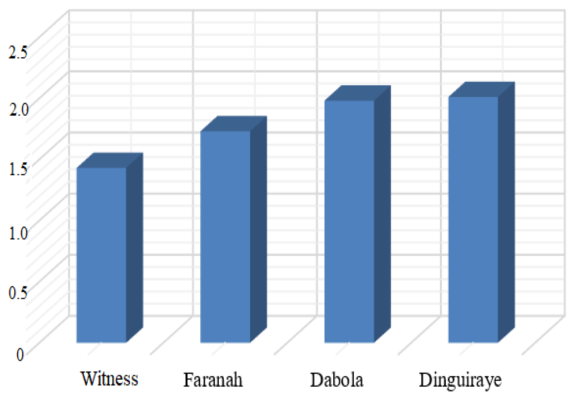

Figure 5: *Diagram of average yields*

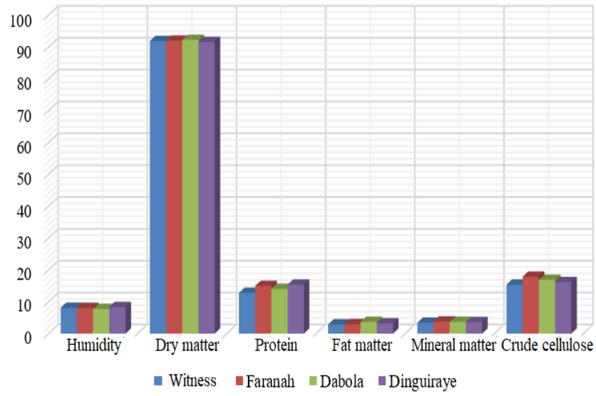

Figure 6: *Diagram of biochemical characteristics of bean seeds*

3.1 Discussion

3.1.1 Agronomic characteristics of cultivated beans

The vegetative cycle varied from 60 to 65 days, which is inferior to the results of some authors (Dupont F., 1989) who indicate that the vegetative cycle of the bean varies from 90 to 108 days or between 75 and 130 days. The average height of the plants is 45 cm, this result is relatively close to that reported in (FAO. 2006 and LECOMTE B. 1997). which varies between 30 to 40 cm for the bean (Phaseolus vulgaris L.) dwarf. The diagram in Figure 3 shows the use of digestate Dinguiraye as fertilizer provided the largest number of pods per plant is 23.45, followed respectively those of Dabola and Faranah is 22.30 and 16.60. The number of pods of the control is 17.25 which is close to the average of the four values is 19.90. The number of grains per pod according to the origin of the digests are respectively: Faranah (3.65), Dinguiraye (3.55), Dabola (3.40) and the control (2.75), with an average of 3.34 seeds per pod. The diagram in Figure 4 shows that the digestate Dabola provided the largest weight of 1000 seeds compared to the digestate Faranah is respectively 546 g and 382 g and other digests gave the intermediate values, with an average of 423.5. This is because the digestate of Dabola contains more nutrients that favor grain filling. From Figure 6, we note that the high yield was provided by the Dinguiraye digestate (2.01 t/ha) followed by that of Dabola (1.98 t / ha). The control gave the lowest yield of 1.43 t/ha. The average yield is 1.78 t/ha, this value is relatively close to that reported in (Poitou-Charentes), which varies between 2.5 to 3 t/ha. These values are relatively higher than the results of some authors, i.e. 1 t/ha (FAO. 2006). Similarly, this average yield is lower than other authors are 7 to 16 t/ha (Centre pour le développement de l'horticulture "CDH", 2012 and Goust J. 2003).

3.2.2 Biochemical characteristics of bean seeds

The diagram in Figure 6 shows that moisture levels in bean seeds grown according to the origin of the fertilizer (digestate) ranged from 7.77% for Dalaba to 8.38 for Dinguiraye, with an average of 8.09%. This value is lower than that given in (Production des haricots secs en Afrique du Sud) i.e. 15 to 16%.Dry matter levels are relatively equal for an average of 91.92%. Protein levels ranged from 12.80% for the control to 15.40% for Dinguiraye, the overall average is 14.32%, values remain below 25% (Daniel C., 2016). The fat and mineral content ranged from 2.91% to 3.70% and 3.43% to 3.85%, respectively, with the following average fats (3.12%) and minerals (3.65%). The crude fiber levels are relatively close, with an average of 16.30%.

4. CONCLUSION

In the framework of the management and the valorization of the digestates resulting from the production of biogas from the animal dung, we experimented the culture of the bean (Phaseolus vulgaris L.) of the dwarf variety GPL 190 of white color in the administrative region from Faranah/Guinea. Digestates (fertilizers) were dosed at 12.5 tones per hectare, these fertilizers were applied differently according to their origins. During this study, some agronomic parameters (average number of pods per plant, average number of seeds per pod, weight of 1000 seeds and yield) and biochemical characteristics of bean seeds (moisture, dry matter, protein, fat, mineral matter and crude cellulose) were determined and compared according to the origin of the digests. These results show that the agronomic and biochemical parameters of the bean varied according to the origin of the digestate.

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