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Comparative Study on the Number of Nodulation of Three Legumes (Peanut, Soybean and Cowpea) and the Correlation with the Level of Fertilization of the Lwama I Site, Town of Kindu.

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ABSTRACT

The present work had as overall objective to make the comparative study on the number of nodulation of three legumes (peanut, soybean and cowpea) and the correlation with the level of fertilization of the Lwama I site, city of Kindu.

To do this, an experimental device in randomized complete blocks, comprising three treatments and six repetitions, was set up;

The results obtained showed that:

- For the number of nodulation, groundnut had higher number with the average of 38 while the lowest number was observed in soybean with the average of 0 and the intermediate number was observed in cowpea with the average of 10;
- For the number of active nodules, groundnut had a higher number with the average of 26 while the lowest number was observed in soybean with the average of 0 and the intermediate number was observed in cowpea with the average of 8;
- With regard to the level of soil fertility in nitrogen, the work done in the laboratory proves that the soil sown with soy had given a very high quantity of nitrogen with the average of 3 mg N/l, while the lowest quantity was obtained in the soil not sown by a legume with a quantity of less than zero mg N/l and the intermediate quantities were obtained in the soil sown by groundnut with the average of 1.6 mg N/l and in the soil sown by cowpea with the average of 1.8mg N/l (Solia 2016).

1. Introduction

1.1. Problem

The history of the world is characterized by the scourge of hunger. In the countries of the South especially, food is quantitatively insufficient and qualitatively devoid of certain nutritional values. It is qualitatively established that the diet in underdeveloped countries is essentially devoid of protein. However, foods of plant origin remain in demand, particularly legumes because they contain a lot of protein due to their ability to fix atmospheric nitrogen thanks to the symbiotic association of these plants with bacteria of the rhizobium genus (Raemarkers, 2001).

In underdeveloped countries, there is a food problem relating to protein malnutrition since meat is considered here as a luxury product for these countries. Legumes are the main source of protein, however it should be noted that vegetable proteins have a lower nutritional value than animal proteins because they are deficient in certain essential amino acids, such as methionine. The richness of legumes in protein is linked, as we know, to their ability to fix atmospheric nitrogen thanks to their root nodules.As a result, on rich soil, they are placed at the end of the rotation while on poor soil, they come at the head of the rotation. In addition, these nitrogen enriching plants therefore constitute a group of considerable agricultural interest in crop rotations and associations (Baboy, 2015).

But it happens that farmers in the province of Maniema, with the decline in yield of food crops due to poor soil, do not know how to identify which of the cultivated legumes can restore soil fertility more by using it in combination. with other crops in order to avoid the high cost of mineral fertilizers and also the transport costs for organic fertilizers.

2. Material and method

2.1. Study environment

The experiments took place within the confines of the University of Kindu, more precisely on the experimental site of the department of phytotechnics located at Lwama 1, with geographical coordinates (S 02°56' 525°; E 025°53'118 and an altitude of 469 m) in the city of Kindu, province of Maniema in the Democratic Republic of Congo.

The concession of the University of Kindu presents a relief characteristic of the central Congolese basin with very little unevenness with a soil of the clay-sandy and sandy-clay type which allow the practice of all kinds of crops, both market gardening and food or industrial. Located in the equatorial zone, our study environment benefits from an equatorial climate: average monthly temperature varies between 22.5 and 29.3°C, with an annual average close to 25°C. As is the case throughout the central forest basin area, annual rainfall varies between 1500 – 2000 mm, with an average of 1750 mm (Van den put, 1981).

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The plant material used in this study consists of three legumes below. These include:

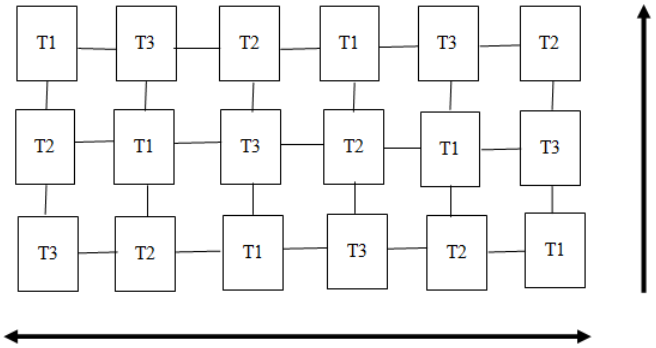
1. Peanut variety G17, seed coat color: red, seed shape: Cylindrical;
2. Munanga variety soybeans, seed coat color yellow, seed shape spherical: elongated ;
3. Cowpea of erect variety, brown seed color, cylindrical seed shape planted.

3. Methods

To carry out our study, we resorted to an experimental method on the ground, to do this an experimental device in complete randomized blocks comprising three treatments and six repetitions, was set up.

3.1. Experimental device and treatment

The figure below illustrates the experimental device adopted in the field.



Legend: T1: Plot sown with groundnuts T2: Plot sown with soybeans T3: Plot sown with cowpeas R1……R6: Repetitions.

3.2. Conduct of the test

3.2.1. Preparation of the land

- Choice of the land was made on 15/12/2021;
- Clearing: we used the machete on 20/12/2021;
- Skidding: as instruments used the hoe, the machete and the rake from 25/12/2021 until 01/01/2022;
-Superficial manual tillage: with the hoe, dated 05/01/2022; - Picketing: from 01/10 to 01/15/2022;
- Labeling: dated 20/01/2022.

3.2.2. Sowing or setting up the trial

The sowing was done in a single line at spacings of 40 cm x 20 cm due to one seed per pocket and this on January 28, 2022.

3.2.3. Cultivation work

The field was maintained by two weedings, the first of which was

Observations were made as follows:

- Pulls the soil sample with the probe to a depth of 10 cm;
- Dig up the plant;
- Immerse the plant in a bucket of water to rid it of the soil;
- Manual counting of nodules;
- And to finish with the transverse section to check the true active nodules and the non-active false nodules.

As work tools: bucket, scales, razor blade. We made six observations as of 03/12/2022.

b. Soil analysis in the laboratory

In relation to our objectives, we proceeded as follows:

1. Filling 50 ml labeling sample container with deionized water;
2. Add a 2 ml scoop of soil to the demineralised water/extract N solution, and shake for one minute;
3. Shake until this powder dissolves;
4. Add a 2ml scoop of soil to the deionized water/extract N solution, and shake for one minute;
5. Add a tablespoon of nitrate and shake for one minute;
6. Pray a filter paper, place the filter funnel in a clean sample container;
7. Pour the soil/extract N solution into the filter and put the filtrate extraction back into the second container;
8. Once the 10ml of filtrate is available, fill the cuvette to the 10ml mark and select photo 007 nitrogen and potometer or test 10;
9. Add a nitricol tablet to the sample filter and crush to dissolve completely;
10. Place the cuvette in the rack for 10 minutes to allow full color development;
11. Insert the cuvette into the photometer and taking the reading in the usual way;
12. The soil nitrogen result is displayed in mg N/l.

 As remark given:

- If the extract is cloudy after the filtration step, the filtration step is repeated to ensure a completely clear filtrate;
- If a displayed result is ≥, the filtrate is diluted with deionized water and the test protocol of step 8 is repeated;
- If an orange color develops following the addition of the nitricol tablet, nitrate result and above measurement caplage. Dilute the filter 10 times and repeat from step 8.

 Materials needed:

- Soil test 10 photometer
- Cuvette pt 595, 10 ml
- Cuvette holders
- Soil shovel, 2 ml
- Sample container / dilution tube x 2
- Filter funnel pt 607, diameter 7 Cm
- Filter paper pt 618, diameter 7 Cm
- Extract N powder
- Nitra test powder N
- Nitricol tablets.

3.3. Statistical analysis

To process our raw data, we used unifactorial analysis of variance (ANOVA) with a posteriori test (test of the least significant difference: PPDS or LSD) and the results obtained were interpreted as follows:

- If HR> Fth at the 5% probability threshold: the difference is significant, i.e. the different treatments used have influenced the parameters studied. In this case, the means obtained from the different treatments are subjected to the PPDS or LSD test in order to determine the statistically different means;
- If FC <Fth at the threshold of 5% probability: the difference is not significant between the different treatments and it is considered that the different treatments used do not show any significant differences. (Mobambo, 2019).

4. Presentation of the results

The raw results obtained on the number of nodules are from the present work and their averages are found below in the tables summarizing the results.

4.1. First observation

With regard to the table above, it is observed that the average number of nodules of all the treatments was 9. However, the highest number of nodules was observed in cowpea (T3) which produced 14 while that the lowest number of nodules was observed in soybean (T2) with 0 and the intermediate number was observed in peanut (T1) with 11 nodules.

Moreover, the analysis of variance shows that there is a significant difference between the different treatments. However, between groundnut and cowpea, there are no

significant differences although cowpea produced 3 nodules more than groundnut.

4.2. Second observation

For the second observation, it follows from this table that the average number of nodules in all the treatments was 10. However, the highest number of nodules was observed in groundnut (T1) with 20; while the lowest number of nodules was observed in soybean (T2) with 0 and the intermediate number was observed in cowpea (T3) with 9 nodules.

Moreover, it appears from the analysis of variation that there is a significant difference between the different treatments. Groundnut produced 13 more nodules than cowpea and is therefore the best treatment.

4.3. Third observation at 22 days after sowing

With regard to the table above, it is observed that the average number of nodules of all the treatments was 16. However, the highest number of nodules was observed in groundnut (T1) with 40 while the number the lowest number of nodules was observed in soybean (T2) with 0 and the intermediate number was observed in cowpea (T3) with 9 nodules.

Moreover, it appears from the analysis of variation that there is a significant difference between the different treatments. However, between soybean and cowpea, there are no significant differences, although cowpea produced 9 more nodules.

4.4. Fourth observation at 26 days after sowing

Looking at Table 2, it can be seen that the average number of nodules in all the treatments was 18. However, the highest number of nodules was observed in groundnut (T1) with 43; on the other hand, the lowest number of nodules was observed in soybean (T2) with 0 and the intermediate number was observed in cowpea with 10 nodules.

Moreover, it appears from the analysis of variation that there is a significant difference between the different treatments. Groundnut produced 23 more nodules than cowpea and is therefore the best treatment.

4.5. Fifth observation at 30 days after sowing

With regard to Table 2, it can be seen that the average number of nodules in all of all the treatments was 23. However, the highest number of nodules was observed in groundnut (T1) with 60; while the lowest number of nodules was observed in soybean (T2) with 0 and the intermediate number was observed in cowpea (T3) with 10 nodules.

Moreover, it appears from the analysis of variation that there is a significant difference between the different treatments. Groundnut produced 40 more nodules than cowpea and is therefore the best treatment.

4.6. Sixth observation at 34 days after sowing

Looking at the table above, it can be seen that the average number of nodules for all the treatments was 21. However, the highest number of nodules was 53 observed in groundnut (T1), while the number The lowest number of nodules was observed in soybean (T2) with 0 and the intermediate number was observed in cowpea (T3) with 10 nodules.

It appears from the analysis of variance that there is a significant difference between the different treatments. Groundnut produced 43 more nodules than cowpea and is therefore the best treatment.

The plants put in association do not present the same vegetative cycles, therefore the different flowering dates, date on which the results were collected. Thus our results showed that among the three legumes studied (groundnut, soybean and cowpea), the strongest nodulation was observed in groundnut. This would explain the difference between the crop cycles of these three legumes. In our study, the greatest plant length and weight were obtained when the legumes were in pure culture. This could be explained by the competition effect of available resources in the soil thus preventing plant growth. These results corroborate those of Louarn et al, (2010). For this author, these results are due to the phenomenon of facilitation, a phenomenon during which a species improves the environmental conditions for the development of the associated species (temperature, shade and availability of resources).

Conclusion

The general objective of this work was to make a comparative study on the number of nodules produced by three legumes (peanut, soybean and cowpea) and the correlation with the level of soil fertility.

The results obtained showed that:

- For the number of nodules, peanuts produced a large number with an average of 38 and it was the same treatment that presented the highest number of active nodules with an average of 26.
- For the level of soil fertility, the soil sown with soy gave the highest amount of nitrogen with an average of 3 mg N/l.

In addition, we observe that legumes add fertility to the soil and that in our study environment, the legume which formed the large number of nodules is not the same legume which transferred a large quantity of nitrogen to the soil.

Table 1. Summary of nodule count results

Treatment	Number of nodules					
	1e obs	2e obs	3e obs	4e obs	5e obs	6e obs
T1	11 a	20 a	40 a	43 a	60 a	53 a
T2	0 b	0 b	0 b	0 b	0 b	0 b
T3	14 a	9 c	9 b	10 b	10 b	10 b
CV %	21,5	15,4	18	5,6	17,2	21,4

The numbers followed by the same letter in the columns are not significantly different according to the PPDS test at 5% probability. Legend: T1: Plot sown with groundnuts T2: Plot sown with soybeans T3: Plot sown with cowpeas CV%: Coefficient of variation

Table 2. Summary of the results of the number of active nodules (true nodules)

Treatment	Number of active nodules (true nodules)					
	1e obs	2e obs	3e obs	4e obs	5e obs	6e obs
T1	2 a	10 a	29 a	35 a	42 a	36 a
T2	0 a	0 b	0 b	0 b	0 b	0 b
T3	7 b	8 b	8 b	9 c	9 b	8 b
CV %	31,9	24,6	18,5	7,9	20,6	29

The numbers followed by the same letter in the columns are not significantly different according to the PPDS test at 5% probability. Legend: T1: Plot sown with groundnut T2: Plot sown with soya T3: Plot sown with cowpea CV: Coefficient of variation

Table 3.Level of soil fertility

Treatment	Amount of nitrogen in mg/l
T0	<< a
T1	1,6 a
T2	3 a
T3	1,8 a
CV %	16,5

The numbers followed by the same letter in the columns are not significantly different according to the PPDS test at 5% probability. Legend: T0: unsown soil T1: soil sown with groundnuts T2: soil sown with soybeans T3: soil sown with cowpeas CV: coefficient of variation. <<: Less than zero relative to the threshold of 0-25 mg N/l.

Bibliographical References

A. The works

1. Eric G, 2007: laboratory of tropical and Mediterranean symbioses, France;
2. JOHN, 1948: University of Arkansa, Department of Agriculture, NSA;
3. Figueiredo MVB, 2008: plant growth promating rhizobacteria for improving nodulation and nitrogenfixation in the common beau (Phaseolus vulgaris) wold 1187;
4. Pierre, 1996: conference-debate l'arstrom, France;
5. Senasem, 2012: varietal catalog of food crops: cereals (maize, rice), legumes (beans, soybeans and cowpeas), tuber crops (cassava, sweet potato, potato), banana. Support for the CTB/Min AGRI project. Kinshasa, p 153;
6. MPIANA, 2010: Course of topography and cartography, G2, FSA, UNIKI, unpublished.

B. Lecture notes

1. Reamarker, 2001: agriculture in tropical Africa, Brussels, 1045 pages;

Vaden put R., 1981. The main crops in Central Africa. Lesafre printing press, B 7500, Belgium;

2. MOBAMBO K.N.P, 2019: Special question course on plant production "field experimentation" II Grade phyto, FSA, UNIKI, 23P Unpublished;
3.SOLIA. E.S., 2016. Study of ecological conditions of Afzelia bipendensis Harms (Fabaceae) in the Kisangani region, DR Congo. Doctoral thesis, University of Kisangani, 284p.
4. KAKUNI M.J, 2019: Phytotrophology and fertilization course, FSA, UNIKI, 70P Unpublished;
5. BABOY L, 2015: Course in the systematics of cultivated plants, 3rd graduate, FSA/UNIKI 69P Unpublished.
6. SOLIA S, 2015: Soil biology course, 1st grade phyto, FSA, UNIKI, 58P, unpublished;
7. NYONGOMBE, 2016: Course in climatology, G1, FSA, UNIKI, 36P, unpublished
8. Webography
1. www.leguminous nutrition.com;
2. www.Medicinesciences.org;
3. www.Larouse.fr;
4. www.cnrtl.fr;
5. www.futura.science.com;
6. Fr.m.wikipedia.org;
7. www.iedafrique.org: importance of legumes;
8. https://argronomie.info;
9. https://fertilisation-endre.fr;
10. www.fao.org