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Research Article

EFFECT OF ORGANIC AND MINERAL FERTILIZERS ON GROWTH AND FRUIT YIELD OF OKRA (*ABELMOSCUS ESCULENTUS*) IN THE VALLEY OF BÉNOUÉ, NORTH-CAMEROON

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Abstract

Study was conducted in the experimental site of Kismatari. Objective of the study is to study the effect of different doses of organic and mineral fertilizers on the development of five varieties of okra in North Cameroon. Levels of doses were: T0 = control, T1 = organic fertilizers (100 % of the compost), T2 = mineral fertilizers (100 % NPK-urea) and T3 = organic + mineral fertilizers (50 % compost and 50 % NPK-Urea). Experimental design was a split plot with 3 replications, which two factors: factor 1 consisting of 5 varieties and the factor 2 with doses of fertilizers (organic and mineral). Evaluation parameters were: the growth of plants (height), the diameters of fresh fruits, the length of fresh fruits, the weight of fresh fruit, the height of insertion of first fruit and the height of plant at the first harvest, precocity and yields. Ours results revealed that there is a significant difference between the growth of variety V4 and that of other varieties in response to organic, mineral fertilizers and the combination of fertilizers from 40 to 80 DAS (days after sowing). However, there is an increase in the height of varieties during the growing. The date of 50 % of flowering and appearance of the floral buttons at 50 % varies according to varieties and levels of doses. However, the flowering at 50 % and appearance of floral buttons are earlier for varieties V2, V3, V4 compared to varieties V1 and V5. Despite the positive differentiation on phenological aspects according to the varieties, the height of insertion of first fruit and height of plant at the first harvest were most significant for the variety V4 with the doses of organic, mineral fertilizers and both fertilizers.

Keywords: Okra, Fertilizers, Doses, Phenology, Yields.

INTRODUCTION

Okra (*Abelmoschus esculentus* (L.)) previously called *Hibiscus esculentus* is an annual plant of the Family of Malvaceae, originate in the basin of the Nile (Aladele *et al.,* 2008). This plant is cultivated as food plant for their leaves, fruits, seeds and even their fibers (Amadou *et al.,* 2019). Consumed like vegetable or as components in the sauce, their fruits are harvested on immature stages two to three weeks after flowering. Okra is one of the most important vegetable crops in the tropics and subtropics, where it plays a key role in the financial equilibrium of peri-urban farming systems (Rasmata *et al.,* 2019; Tshomba *et al.,* 2015). Okra develops well in the low regions (1000 à 1500 m) of tropical and equatorial climates (Memento, 2002). On the nutritional level, Okra has a high content in calcium and ascorbic acid. Seeds of okra contain around 20 % of proteins and 20 % of lipids (Siemonsma & Hamon, 2004; Vanier, 2008). They contribute to increased livelihoods of both rural and urban populations (Idi *et al.,* 2019; Kumar *et al.,* 2011). This is especially because of its robust nature, dietary fibers and distinct seed protein balanced in both lysine and tryptophan amino acids it provides (DS/MDA, 2008; Idi *et al.,* 2019). In West of Africa, okra is the second vegetables culture after Tomato (Memento, 2002). We encounter a very high diversity of local okra. It's also a big vegetable which is important in Cameroon. His culture is made in the regions of West (13.8 %), Far-north (61.7 %) and Center (15.9 %) (INS, 2010). In North region specifically in Garoua, all types are produced and African legumes are mostly (70 %) by women. In Ngaoundéré where mainly European legumes are produced, women are about 15.3 % of all producers (Nchoutnji *et al.,* 2009). Okra culture production was evaluated at 8.900 ton for the agricultural values estimated at 4.004 billion of FCFA (INS, 2010). But this production is still very far to satisfy the interior requirement. Okra constitutes one of vegetable which is most consumed by Cameroonians populations. His fruit is used as binder in the preparation of sauce whereas their leaves are consumed like spinach in some localities (Siemonsma & Hamon, 2004). For optimize their production, peasant make recourse to fertilizers and product of health plant, particularly in the locality in the North region around the Bénoué. The fertilization of culture implicates necessarily a handling of organic and mineral fertilizers on field. Challenge of the fertilization of cultures is to made so that the intervention of producer is planned of manner that the cultivated land plots supply nutrients during the season necessarily on optimal growing of culture and on obtaining of good yields (Pierre Jobin and Jacques Petit, 2005). In the actual context where the producers and vegetable farmer hope to optimize their production for increase their accessibilities and reduces their levels of poverty, it is important to control the fertilization of this vegetable in order to help better to improve their incomes. NPK fertilizer increases soil fertility and okra yield. However, it is very expensive and therefore increases the cost of production. It is also not environmentally friendly. Compost is important because it contains the main plant nutrients nitrogen (N), phosphorus (P) and potassium (K), often written as NPK; improves the organic matter in the soil by providing humus; helps the soil hold both water and air for plants; and makes trace elements or micronutrients available to plants. However, organic fertilizers are not always available. Even if they are available, the uses of these fertilizers are marginal and the

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knowledge of the optimal doses is not controlled by okra producers as well professional as not professional. Innovations is not only in agriculture, but also in other scientific fields such as biotechnology, medicine which applying of the Bio-Fertilizer Herbagreen that are able directly penetrate plants, even this method can avoid or reduce the soil and waters contamination caused by only traditional mineral fertilizers use (Doloreza Prifti and Ardian Maçi, 2017). However, the fertilization on natural environment by the use of organic fertilizers to poor and acid soils permits to supply nutrients elements necessary on the growing and on the production of cultivated plants (Amadou *et al.,* 2019; Useni e*t al.,* 2013). The combinations of fertilizers are an alternative source for enhance the productivity of Okra. Judicious user of manure and chemical efficient fertilizers use has to be followed to increase the input use efficiency (Jagtap *et al.,* 2018). This study focuses on the response of five varieties of okra to organic and mineral fertilizers. The aim is to study the effects of different doses of these fertilizers on the growth and yield of okra in the Bénoué Valley, in the North Cameroon.

MATERIALS AND METHODS

Description of the study area

Field experiment was conducted at the experimental site of the Institute of Agricultural Research for Development (IRAD) in Kismatari around 10 Kilometers of town of Garoua, region of Cameroon. Geographical coordinates these localities are: 09°34'310'' of North latitude and 013°27'712'' of East longitude. The climate of this locality is Sudano-Sahelean types with two seasons: a short raining season beginning from May to September and long dry season beginning from October to April.

Materials

Vegetal materials are constituted of 5 local varieties of okra, with three varieties from Far North (Maroua) and two others from North (Pitoa and Takasko Garoua). The technical material consisted of compost which is an organic fertilizer; NPK mineral fertilizer of the 20-10-10 formula.

Experimental design

The experiment was arranged in split plot with 20 treatments replicated three (3) times. Two factors were considered: the main factor was five (5) varieties and the second factor was the fertilizers with four levels of doses: T0, T1, T2 and T3. Plot size was 2.4 × 2 m and each elementary plot was sowed with 4 rows of 2 m and each rows had 5 pockets. The planting distances were 80 cm between rows and 50 cm within rows, with 24 plants per plot. Two seeds were planted per hill.

Test implementation: Soil preparing process beginning is consisted to clear the plot, made labour and leveling. Fertilization was made one day before sowing. 3 to 4 seeds were sowing and plants were reduced at one plant per pockets. Seeds were treating before sowing by Momtaz (insecticide and fungicide for the seeds). Treatment by herbicide base on the uses of Glyphader 750 SG (systemic herbicide of post emergence) and ACTION 80 DF (herbicide of pre-emergence) were applied same day in order to clear the plots. Labour was made after weeding.

Organic fertilization: Organic fertilizers applied are compost mixed with poultry manures (70 %) and beef dejections (30 %). Treatments applied are: T0 = control, T1 = Fertilization with organic manure (100 % of compost), T2 = Fertilization with mineral fertilizers (100 % of NPK + Urea) and T3 = Fertilization with organic + mineral fertilizers (50 % compost and 50 % NPK + Urea). Plots were received fertilizers (the compost) are the plots having the treatments T1 and T3. Dose applied was of 10 t/ha. Electronic scale was used to weight compost on the site. Fertilizers were applied in all of plots considered.

Mineral fertilization: Mineral fertilization was applied ten (10) days after sowing at the doses of 250 kg of NPK at the formulation of 20-10-10 par/ha + 250 of Urea 46 % N/ha. For the treatments T2, 100 % of NPK and 50 % of Urea were applied on a unique dose. For the treatment T3 half of the normal dose of NPK and urea was applied per elementary plots. Following the technical route, the NPK was applied only once, the urea was split into two dates.

Assessment of agronomic parameters

Methods of assessment of growth parameters and the phenological stages are summarized in Table 1 below.

Table 1. Parameters used for collect data.

N°	Parameters	Methods
1	Height of plants (cm)	Measuring with a decameter
2	Date of flowering at 50 % (DAS)	Count at the day after sowing
3	Date of 50 % of the floral buttons (DAS)	Count at the day after sowing
4	Height of insertion of first fruit (cm)	Measuring with a ruler
5	Height of plant at the first harvest (cm)	Measuring with a decameter
6	Diameters of fresh fruit (mm)	Measuring with caliper
7	Length of fresh fruit (cm)	Measuring with a ruler
8	Weight of fresh fruit (g)	Weighing with electronic balance
9	Yield of seeds per plant (g)	Weighing with electronic balance

Statistical Analysis

The collected data were ordered and classified in the Microsoft Excel spreadsheet 2017. These data were transferred to the R-commander software, for analysis of variance (ANOVA) and the means were separated using Kruskal's test at the 5 % probability threshold.

RESULTS

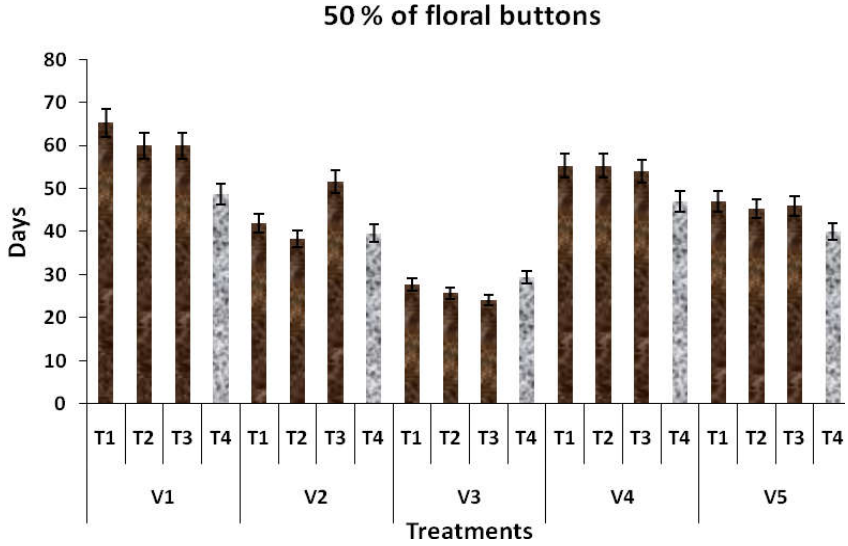
Effect of treatments on height of plants

Heights of plants according to the doses and varieties at 20^{th}, 40^{th}, 60^{th} and 80^{th} DAS is showed on table 2. According for this table, height variations of plants depend of the doses of fertilizers and varieties. For the average height of plants at 20^{th} DAS, only the variety V5 recorded a maximal height (11.50 cm) by the use of both fertilizers (50 % compost+50 % NPK-Urea) compared to the control dose. Compared to control, average variations of height of plants at 40^{th}, 60^{th} and 80^{th} DAS according to Kruskal test were increased for the majority of cases for the varieties V1, V3, V4 and V5 by the use of organic fertilizers (100 % of compost), mineral fertilizers (100 % NPK-urea) and the combination of fertilizers (50 % compost+50 % NPK-urea). Contrary to the variety V2 where the response is well by to the uses of organic fertilizers. Statistically, only the doses of organic fertilizers, mineral fertilizers and both fertilization were significant ($P \leq 0.05$) on height of plants at 40^{th} and 80^{th} DAS for the variety V4.

Table 2. Effect of different doses on height of plants according to the varieties (cm)

Doses	V1	V2	V3	V4	V5
	H20	**H20**	**H20**	**H20**	**H20**
T1	8.31±0.68a	11.94±0.95a	9.01±0.82a	7.06±0.39a	8.50±2.35a
T2	8.04±0.60a	10.50±2.14a	8.70±1.35a	8.04±0.98a	10.17±1.36a
T3	7.53±1.57a	9.72±0.82a	9.39±0.60a	8.30±0.61a	8.83±3.55a
T4	8.47±0.59a	9.78±1.59a	10.31±0.98a	8.40±0.53a	11.50±2.53a
	V1	**V2**	**V3**	**V4**	**V5**
	H40	**H40**	**H40**	**H40**	**H40**
T1	20.29±3.18a	33.86±6.39a	22.19±8.21a	16.92±2.27b	24.20±7.31a
T2	32.47±5.82a	43.69±12.66a	33.49±1.74a	27.81±5.34a	37.02±5.30a
T3	27.86±0.92a	32.83±6.11a	32.33±5.44a	30.72±6.01a	34.42±6.04a
T4	27.14±5.45a	30.17±4.59a	28.14±6.30a	20.88±3.37b	32.17±11.97a
	V1	**V2**	**V3**	**V4**	**V5**
	H60	**H60**	**H60**	**H60**	**H60**
T1	47.67±5.70b	78.11±22.22a	56.94±11.74b	46.67±7.42a	51.72±13.80b
T2	74.65±9.03a	97.22±22.11a	75.31±8.12a	55.81±9.87a	63.57±12.05a
T3	68.72±6.84a	72.61±12.51a	79.44±15.82a	71.42±11.37a	72.87±9.27a
T4	62.21±13.43a	71.11±9.61a	66.17±23.03a	43.42±7.83a	77.28±28.40a
	V1	**V2**	**V3**	**V4**	**V5**
	H80	**H80**	**H80**	**H80**	**H80**
T1	47.67±5.70b	131.00±31.94a	77.83±27.60b	71.28±15.54b	79.71±5.82b
T2	133.64±17.08a	153.56±33.15a	100.77±11.27a	101.69±18.20a	107.04±5.57a
T3	124.28±13.61a	122.20±13.71a	110.56±18.65a	129.90±12.71a	123.82±12.30a
T4	120.70±34.34a	125.83±13.55a	91.89±35.42a	75.81±7.75b	122.42±33.67a

NB: Treatments with the same letter are not significantly different at the level of probability considered ($P \leq 0.05$). **V1** = variety 1; **V2** = variety 2; **V3** = variety 3; **V4** = variety 4; **V5** = variety 5; **T1** = control; **T2** = 100 % compost; **T3** = 100 % NPK-urea; **T4** = 50 % compost+50 % NPK-urea. **H20** = height at 20th DAS; **H40** = height at 40th DAS; **H60** = height at 60th DAS; **H80** = height at 80th DAS.



NB: Treatments with the same color are not significantly different at the level of probability considered ($P \leq 0.05$). **V1** = variety 1; **V2** = variety 2; **V3** = variety 3; **V4** = variety 4; **V5** = variety 5; **T1** = control; **T2** = 100 % compost; **T3** = 100 % NPK-urea; **T4** = 50 % compost+50 % NPK-urea.

Figure 1. Effect of treatments on appearance of 50 % of floral buttons by varieties

Effect of treatments on flowering process

Date of 50 % floral buttons: Figure 1 illustrates the date of 50 % of floral buttons for each variety according to the doses. The date of appearance of floral buttons varies according to varieties and doses. Varieties V3 and V2 were earlier compared to the varieties V1, V4 and V5 which are late. Effect of the doses influenced on the date of appearance of floral buttons at 50 % of different varieties. The treatments based on compost (at 100 %) favoured earlier the appearance of floral buttons for the varieties V1, V2, V3 and V5. Contrary to the uses of mineral fertilizers (100 % of NPK-urea) which favour earlier the appearance of floral buttons of varieties V1, V3 and V5. The combination of fertilizers (50 % of compost+50 % of NPK-urea) favoured earlier the appearance of floral buttons of varieties V1, V2, V4 and V5.

Flowering of plants at 50 % according to the varieties: Figure 2 shows the flowering of plants at 50 % according to different formulations of doses and varieties. Flowering at 50 % was earlier appeared by the uses of organic fertilizers (compost at 100 %), mineral (NPK-urea) and the combination of both fertilizers (50 % of compost+50 % of NPK-urea) on varieties V1 and V5. Contrary to varieties V2 and V4, flowering at 50 % was induces earlier by the uses of compost (100 %) and the combination of fertilizers (50 % of compost+50 % of NPK-urea).

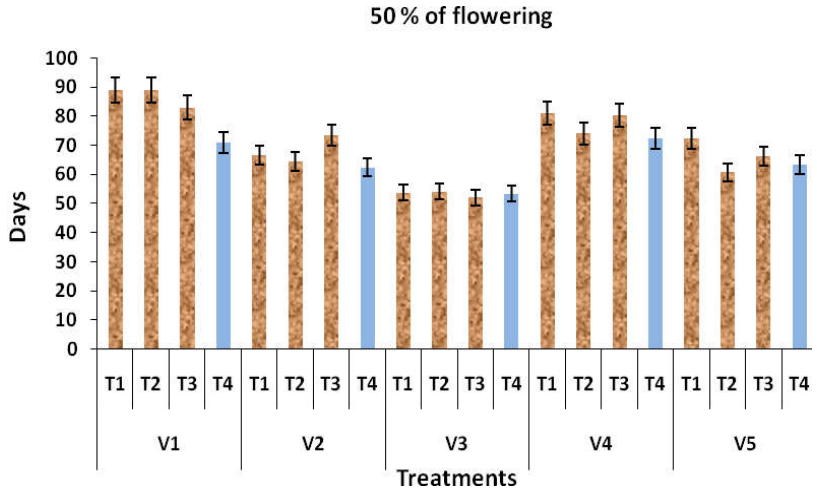
Productivity of plants

Effect of treatments on yields parameters: Table 3 shows the effect of the doses of fertilizers on different aspects of phenology of plant (diameters of fresh fruits; the length of

Table 3. Effect of the different doses on yields parameters according to the varieties

Doses	V1				
	DFF (mm)	**LFF (cm)**	**WFF (g)**	**HIFF (cm)**	**HPFH (cm)**
T1	98.97±6.16a	10.59±1.36a	26.58±4.67a	105.92±19.62a	131.31±22.45a
T2	100.21±0.52a	08.27±0.69a	24.50±4.89a	107.78±23.28a	140.56±17.77a
T3	98.13±6.80a	09.27±1.10a	20.45±5.61a	143.92±32.87a	179.81±26.84a
T4	96.28±4.32a	09.79±0.93a	25.60±8.31a	113.17±22.14a	147.58±35.04a
	V2				
	DFF (mm)	**LFF (cm)**	**WFF (g)**	**HIFF (cm)**	**HPFH (cm)**
T1	87.44±5.99a	13.42±0.95a	36.07±1.12a	82.33±15.93a	135.58±23.93a
T2	83.16±5.12a	13.32±1.77a	32.60±4.95a	99.42±33.88a	152.72±31.04a
T3	88.02±6.07a	11.72±0.25a	28.44±5.18a	99.00±9.17a	147.81±9.43a
T4	84.14±4.82a	12.94±0.71a	29.64±4.77a	66.50±15.75a	122.58±19.26a
	V3				
	DFF (mm)	**LFF (cm)**	**WFF (g)**	**HIFF (cm)**	**HPFH (cm)**
T1	73.18±1.59a	19.05±3.75a	44.10±16.27a	26.13±1.84a	58.08±7.99a
T2	71.78±3.45a	21.09±1.13a	58.15±11.67a	38.78±2.56a	81.64±8.99a
T3	74.02±2.90a	21.90±1.27a	48.50±9.60a	40.75±9.16a	90.67±12.50a
T4	73.18±1.59a	19.05±3.75a	44.10±16.27a	30.21±8.31a	70.49±22.45a
	V4				
	DFF (mm)	**LFF (cm)**	**WFF (g)**	**HIFF (cm)**	**HPFH (cm)**
T1	89.27±8.03a	9.43±0.51a	21.00±5.57a	58.47±3.65b	77.3±5.25b
T2	87.02±2.12a	13.02±4.02a	36.80±15.11a	85.06±22.44ab	119.89±23.54ab
T3	94.16±2.40a	10.09±0.39a	24.54±4.21a	118.92±20.73a	152.08±30.07a
T4	87.83±8.86a	9.44±1.40a	26.67±5.05a	63.50±7.40b	90.67±8.57ab
	V5				
	DFF (mm)	**LFF (cm)**	**WFF (g)**	**HIFF (cm)**	**HPFH (cm)**
T1	82.26±2.95a	14.70±1.80a	33.47±1.50a	59.25±20.88a	94.03±20.77a
T2	80.38±5.53a	14.97±2.45a	33.45±5.79a	52.19±16.61a	90.33±15.40a
T3	90.01±7.79a	13.39±3.46a	25.47±4.05a	86.69±27.97a	136.00±37.89a
T4	86.78±11.88a	13.71±3.28a	30.25±8.96a	98.19±51.95a	112.58±70.55a

NB: Treatments with the same letter are not significantly different at the level of probability considered ($P \leq 0.05$). **V1** = variety 1; **V2** = variety 2; **V3** = variety 3; **V4** = variety 4; **V5** = variety 5; **T1** = control; **T2** = 100 % compost; **T3** = 100 % NPK-urea; **T4** = 50 % compost+50 % NPK-urea. **H20** = height at 20th DAS; **H40** = height at 40th DAS; **H60** =height at 60th DAS; **H80** = height at 80th DAS.



NB: Treatments with the same color are not significantly different at the level of probability considered ($P \leq 0.05$). **V1** = variety 1; **V2** = variety 2; **V3** = variety 3; **V4** = variety 4; **V5** = variety 5; **T1** = control; **T2** = 100 % compost; **T3** = 100 % NPK-urea; **T4** = 50 % compost+50 % NPK-urea.

Figure 2. Effect of treatments on 50 % flowering by varieties

fresh fruit; the weight of fresh fruit; the height of insertion of first fruit and the height of plant at the first harvest) according to the varieties. Diameters of fresh fruits were important with the doses of organic (100 % compost), mineral (100 % of NPK-urea) and the combination of both fertilizers (50 % compost+50 % NPK-urea) for the varieties V1, V4 and V5. But not significant differences ($P \leq 0.05$) were recorded among the comparison of treatments. The length of fresh fruit was important for the doses of organic fertilizers, mineral and the combination of both fertilizers for the varieties V3 and V4. Organic fertilization, mineral and combination of both fertilizers (organic and mineral) were increased the weight of fresh fruit of the varieties V3 and V4 compared to control doses.

Statistically not significant results ($P \leq 0.05$) were noticed among treatments. The different doses of organic, mineral fertilizers and both fertilization were increased the height of insertion of first fruit for the varieties V1, V3 and V4 comparatively to control dose. Contrary to the varieties V2 and V5, where the height of insertion of first fruit was important by the uses of only organic and mineral fertilizers. The varieties V1, V3 and V4 have the height of plant at the first harvest most important by the uses of doses of organic, mineral and both fertilizers treatments (organic and mineral), compared to control. Contrary to the variety V2 which response better by the use of organic fertilizers (compost) and mineral (NPK-urea) with an important height, compared to control. But the variety V5 where rather the mineral fertilization and the

combination of the doses of both fertilizers were important on the height of plant at the first harvest, compared to control dose. Statistically, only the doses of organic fertilizers, mineral fertilizers and both fertilizers (organic and mineral) were significant (P≤0.05) for the variety V4 on the height of insertion of first fruit (HIFF) and height of plant at the first harvest (HPFH).

Effect of the doses on weight of seeds by varieties: Table 4 shows the average weight of 1000 seeds of different varieties in function of treatments. The weight of 1000 seeds varies according to the varieties. Compared to control, uses of organic fertilizers, mineral fertilizers and the combination of both fertilizers increased the average weight of 1000 seeds for the varieties V1, V2, V3, V4 but statistically not significant (P≤0.05). We recorded a decrease of rate of weight for the varieties V5 by the uses of organic fertilizers (compost) and mineral (NPK-urea).

Table 4. Effect of the doses on the average weight of 1000 seeds by varieties

Doses	Weight of 1000 seeds (g)				
	V1	**V2**	**V3**	**V4**	**V5**
T1	4.89 ±0.21a	5.33±0.68a	6.07±0.31a	4.53±0.19a	6.01±0.37a
T2	5.23±0.54a	5.58±0.19a	6.00±1.02a	5.19±0.71a	5.91±0.23a
T3	4.99±0.71a	5.78±0.15a	6.70±0.35a	5.25±0.15a	5.74±0.08a
T4	5.45±0.25a	5.63±1.07a	6.49±0.56a	5.27±0.67a	6.22±0.48a

NB: Treatments with the same letter are not significantly different at the level of probability considered (P ≤ 0.05). **V1** = variety 1; **V2** = variety 2; **V3** = variety 3; **V4** = variety 4; **V5** = variety 5; **T1** = control; **T2** = 100 % compost; **T3** = 100 % NPK-urea; **T4** = 50 % compost+50 % NPK-urea.

DISCUSSION

Results on the height of plants proved that an increasing in the majority for the different varieties by organic fertilizers (compost), mineral fertilizers (NPK-urea) and the combination of both fertilizers (50 % compost+50 % NPK-urea) at 40th to 80th DAS (days after sowing). During this interval of this day, the increasing is most significant for variety V4 with doses of organic fertilizers, mineral fertilizers and both fertilizers. Nitrogen is one of factors which are important for plants and provides to organic fertilizers (Jacques and Pierre, 2005). They favour a good growing on height of plants. Similarly, Pizongo (2014) by their works on the responses of varieties of okra on chemical fertilizers and organic manure proves that the height, diameters of plants increases significantly at 45th DAS with the uses of organic manures (compost), mineral fertilizers (NPK) and both fertilizers. In the same cases works of Touré (2013) on evaluation of the effect of fertility of urine and compost based on human's dejections in okra showed that growing on height become heterogeneous in function to different types of fertilizers at 40th DAS. Same cases were also recorded by Florita (2016) on the performance of two hybrids of Euphorbia (*Euphorbia fulgens*) with the use of organic manure that positively improve the number of leaves, number of shoots, plant height, and stem girth. Correlation was also noticed by Aiachi et al. (2014) on growing and yield responses with water relationship of different varieties of (*Olea europaea*) cultivated under two water conditions in semi-arid conditions. They found that leaves properties, shoot growth and yields were more important for trees which received a higher quantity of water. Date of flowering at 50 % varies according to the varieties used and varies in function of the doses of fertilizers applied. That mean an earlier flowering which varies according to the varieties and the different doses used. In this cases flowering at 50 % of the varieties V2 and V4 is earlier with the used of compost and the combination of fertilizers. For the varieties V1 and V5 this flowering was also earlier by the uses of organic fertilizers (compost at 100 %), mineral (100 % of NPK-urea) and both fertilization (50 % compost+50 % NPK-urea). According to Abdourahamane et al. (2020), the phosphorous stimulate the flowering of plants and precocity of flowering. Contrary this difference is not statistically significant within the different varieties and the doses formulated. Contrary to the works of Pizongo (2014) to the responses of the varieties of okra on chemical fertilizers and organic manures, flowering at 50 % was significant for some varieties which distinguish them in categories. Appearance of floral buttons at 50 % varies according to the varieties and the doses of fertilizers recommended. That means a discontinuity on the date of appearance of floral buttons which permit to conclude that varieties V3 and V2 are earlier compared to the varieties V1, V4 and V5 (late). However, this differentiation according to varieties is depending to the different doses of fertilizers formulated. Precocity of flowering and flowering are stimulated by different fertilizers types (Abdourahamane *et al.,* 2020). According to ours results on diameters of fresh fruit (DFF) by varieties, we record for the variety V1 an increasing which is not significant by the uses of organic manures and for the varieties V4, V5 which the uses of mineral fertilizers. The length of fresh fruit (LFF) according to ours results was increased lightly with the uses of organic and mineral fertilizers for the varieties V3 and V4, but not significant. Similarly works of Mboua (2014) on the identification of some organic and mineral formulations benefits to vegetables farmers of okra showed that the length and diameters of fruit by the uses of different doses did not have a considerable effect on maturation. Also according to Pizongo (2014), the length and diameters of fruit in maturity by the uses of chemical doses of fertilizers and organic manures did not significant for some varieties. Concerning the weight of fresh fruit (WFF) we have an increasing which is not significant for the varieties V3 and V4 by the uses of doses of organic fertilizers, mineral fertilizers and both doses of fertilization. Similarly works of Mboua (2014) showed an increase of weight of fresh fruit (WFF) of okra by the uses of organic and mineral fertilizers. In the same cases Pizongo (2014) proves that the weight of fresh fruit did not significant for some varieties of okra, that mean the weight of fresh fruit depend on the different doses of fertilizers and the varieties used.

However, we have an increasing of the height of insertion of first fruit (HIFF) of varieties to different doses of organic and mineral fertilizers, but most significant for the variety V4 with the formulations doses of organic fertilizers, mineral fertilizers and both fertilization doses. The organic amendments bring some quantities of nutrients elements (Nitrogen, Phosphorous, Calcium, and Potassium) providing to the mineralization and which are important on growing of plants (Pierre Jobin and Jacques Petit, 2005). The height of plants at the first harvest (HPFH) increased for the varieties with different doses of fertilizers but statistically most significant for the variety V4 with the doses of organic fertilizers, mineral fertilizers and both fertilization doses. According to works of Tchaniley et al. (2020), Nitrogen is one an essential factor of growing of plants mostly on the leaves and the stems of plants. Average weight of 1000 seeds evaluated according to different formulations doses of fertilizers applied (organic and mineral) were statistically not significant despite a lightly increase for some varieties used (V1, V2, V3, V4). It is relatively constant for all

the treatments. That is not similar of works of Pizongo (2014) where, the responses of varieties on chemical fertilizers and organic manures were significant for some varieties. Contrary of works of Tchaniley et al. (2020) on Lettuce plant showing that the amended plots by organic manures were most productive compared to control.

Conclusion

This study was made to evaluate the effect of doses of organic and chemical fertilizers in others to identify the different doses of fertilizers that are the most productive. Ours results revealed that among the different treatments used, growth of plants is important with uses of organic, mineral fertilizers and both the combination of fertilizers than other varieties at 40^{th} and 80^{th} DAS (days after sowing). However, this study permits to conclude that height of insertion of first fruit (HIFF) and height of plant at the first harvest (HPFH) of variety V4 response well at doses of organic, mineral fertilizers and both the combination of fertilizers than other varieties. Concerning the yields (weight of 1000 seeds), we recorded not significant difference with uses of organic fertilizers, mineral fertilizers and both fertilizers compared to control plots.

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