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Multiplication of Two Varieties of Both Plantains (Kadaga and Agbavé) and Banana (Fokona and Adokpa) Growing in Togo

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ABSTRACT:

The banana (Musa spp.) is a plant that has a great economic interest. Its fruits are much consumed by the populations of the countries of the south. They have several virtues, among which are the reduction of blood pressure, the prevention and cure of ulcers. The cultivation of banana is made from conventional discharges. It has been found that each mother base gives fewer than ten discharges per year. This lack of rejections means that there is no intensive cultivation of bananas in Togo. It is necessary to find solutions to this problem which justifies this. The general objective of this study is to contribute to the improvement of the technique of rapid multiplication of the planting material of banana and plantain. The PIF technique was used. Ten rejects of each variety are used for the experiment, considering each explant as a repetition. According to the experimental results, the latency period is shorter in the Kadaga variety (27.1j) and longer in the Adokpa variety (34j). For the number of plants weaned at 150 days, the Agbave variety is the best with an average of 38 plants, followed by the Kadaga variety (7 plants); Fokona (4 plants) and Adokpa (3 plants). For the budding rate, the Kadaga variety is the best with 100%, followed by the Agbavé variety 90%, then Fokona 70% and finally Adokpa 50%. The Kadaga variety has a higher success rate after weaning which is 88.23% whereas the Adokpa variety has the lowest rate 58%. The PIF technique makes it possible to multiply the local varieties of bananas and plantains of Togo; but it must be improved and adapted to each variety.

Keyword: *Banana, Plantain, PIF technique, Weaning, Acclimatization, Republic of Togo.*

INTRODUCTION

Banana (Musa spp.) is a fruit plant of great food, economic and socio-cultural importance. Of the genus Musa and belonging to the family Musaceae, it is very cultivated in the tropical regions of the world. Banana ranks fourth in human consumption after rice, wheat and maize [1]. With a production of more than 106 million tons per year, bananas rank first in fruit production [2]. Bananas are a staple food for millions of people in developing countries. In 2011, banana was the most consumed fruit in the world with a worldwide production of more than 100 million tons. In South America the top four banana producing countries are Brazil, Colombia, Ecuador and Venezuela. Countries like Honduras, Panama, Mexico are the best banana producers in Central America. In Asia, there are China, India, the Philippines, Indonesia, Thailand and Vietnam which are the main producing countries. In Africa, the leading countries in banana production are Burundi and Tanzania [3]. Currently, banana is grown in about 150 countries around the world on an area of 5.0 million hectares with a production of 103.6 million tons. Asia, Africa and Latin America are the main producing continents. Among the leading banana producing countries, India leads the production with a coverage of 776 000 ha with 26.5 million tons of production, followed by China which produced 10.5 million tons and Philippines, Ecuador, Brazil which produced respectively 9.2; 7.0 and 6.9 million tons [4]. The latest data on bananas in Togo date back to 2013, with production of 23,198.00 tons, an export value of US $ 1,000. However, plantain data are not available for the same year [5].

The most useful banana product is the fruit (banana). The fruit can be eaten fresh (sweet bananas or dessert bananas) or cooked (plantains and other cooking bananas). In Togo, bananas are foods of great importance. The digestibility of bananas is well known. These fruits are rich in carbohydrates necessary for the production of energy in the human body. They also contain vitamin C and are particularly rich in potassium (K), which is essential for maintaining heart function and body water balance, and so on. Plantain varieties with dark yellow flesh contain a significant proportion of vitamin A, which is essential for both vision and bone growth [6].

These fruits are also a great source of cash income for producers and have therapeutic properties such as lowering blood pressure, prevention and healing of ulcers [7].

Despite these virtues, it is unfortunately noted that in Togo, bananas are produced mainly in certain areas of the Plateaux region. This banana production is almost destined for self-consumption, which is also low compared to that of other countries. In fact, per capita consumption in Togo is 3.29 for plantains and 0.22 for sweet bananas. In Ghana these figures are respectively 0.84 and 96.35; in Cameroon it is 16.95 and 73.61 [8-9].

Koukouma's research in 2005[26] revealed that there are five (5) sweet varieties in Togo west of the Dankodu plateaux region;

Sikodu, Fokona; Adokpa; Evékodu "; 6 varieties of plantain "Agbavé"; Apim, Kadaga, Taevé, true Abladzo; Asikpui "and an intermediate variety called Abidjankodu. The propagation of banana is made from rejects from the mother plant and which constitute the traditional planting material. This natural propagation pathway is slow, laborious and produces small quantity and especially low phytosanitary waste [10].

The technique PIF (Technique Plants stemming stem fragments) developed by Kwa in 2003[17] in Cameroon, is a rapid multiplication technique in vivo by which one can obtain 10 to 20 shoots in a month. The study of the response of banana cultivars to the BIP technique by this author showed that not all cultivars responded in the same way. In addition, the mass of the explant would influence the ability to proliferate.

In Togo, banana cultivation does not attract much interest among farmers, despite their importance as a food and economic resource. They are often grown on small farms, in house gardens, in pens or as fences for houses [11]. The banana and plantain varieties found in Togo yield less than ten releases per parent and per year [12]. This situation of lack of rejects does not allow the farmers to make a monoculture of banana and plantain. Different vegetative propagation techniques have been developed *in vitro* to produce massive quantities of plants: micropropagation from meristems grown in agar or liquid medium, somatic embryogenesis, suspensions embryogenic cells, etc. [13-16].

However, in spite of the success obtained with these methods to multiply the banana plants used in industrial plantations, these *in vitro* techniques are not adapted to the small producers of the southern countries which are regularly confronted with the problem of the availability of the rejects to create, replant or extend their banana plantations [17].

It is therefore difficult to make an industrial production of Banana without having enough discards. What are the distinctive characteristics of each variety for multiplication by PIF? What are the most successful varieties in seedling production using PIF? The research hypotheses are: 1-The distinctive characteristics of each variety are not known. 2-Some varieties are more efficient by the technique PIF. It is necessary to characterize the multiplication of Togo varieties by the technique PIF. For this, we initiated the study of: "Multiplication of two varieties of plantains (Kadaga and Agbavé) and two banana varieties (Fokona and Adokpa) grown in Togo". Based on Koukouma's work in 2005 [26]; these four varieties are appreciated by producers and consumers; which motivates their choice for this study.

The general objective of this study is to contribute to the improvement of the technique of rapid multiplication of planting material of banana and plantain and has the specific objectives of: (1) to define the distinctive characters of each variety and (2) to determine the best varieties according to the PIF technique.

The improvement of this multiplication technique will make Togolese peasants available; a large number of planting material of banana and plantain to bring the country to an industrial production of these fruits.

MATERIAL AND METHODS

Plant Material

The plant material consisted of rejects of two varieties of plantains, and two varieties of dessert bananas. The plantains were supplied by the peasants of Agbesia and Tovégan, while the dessert bananas come from Agou. Discards are the stem fragments used here in the PIF technique (Plants from Stem Fragments) (Figure 1). Each fragment has several latent buds that must be activated by the lifting of the apical dominance, this is the basic principle on which the PIF technique is based. This emergence occurs following the destruction of the apical meristem. Ten discards were used for each of the four varieties.

Figure 1: Banana bayonet discards used

Technical material

To carry out this work, the materials were used, the picks to take the field rejects, the cut-cuts and knives to cut the plant material. The scale was used to weigh the explants. The baskets covered with transparent plastic together constitute germiners (Spreaders), the transparent plastic was used in this case to create the greenhouse effect, by letting the light of day necessary for the photosynthesis of the shoots. The substrate used for soilless cultivation was sawdust. The thermometer and the hygrometer were used respectively to take the temperature and the hygrometry, to check the experimental conditions; seeded explants were labeled. The label bore the name of the variety, the date of seeding, the mass of the explant and the serial number. A plastic watering can was used for watering. The 0.5l black plastic sachets containing the potting soil were used for the acclimation of weaned vivoplants. Banko Plus Fungicide was used to disinfect all explants.

Methods

PIF (Plants from Stem Fragments) was used in the experiment. Indeed this technique was developed by Kwa in 2003[17] in Cameroon and has as a basic principle the lifting of apical dominance.

The preparation of the collected fragments began with the washing of the rejects with tap water, the roots were then cleared with knives. A clearcut was done; it consisted in peeling the stem of the rejections up to 3 to 5mm or exceptionally up to 1 cm deep to avoid a possible presence of nematodes. Shelling consisted of removing three to four leaf sheaths taking care to leave 2 mm of sheath above the corm boundary while the pseudostem of the rejection was reduced to (5 or 10) mm above the last sheath. visible node of the rejection stem. Two to three crossed incisions were made in the center of the explant to destroy the apical meristem and lift its dominance. The explants were dried for 24 hours under shading after disinfection with Banko Plus fungicide (550 g / l Chlorothalonil + 100 g / l Carbendazime) at a rate of 2 ml / l of water for 30 minutes.

The explants were put in sprout (Basket) on a sawdust layer about 10 cm, previously watered then covered with sawdust of a layer ranging from 3 to 5 cm; the first watering was done just after planting in sawdust. One or two water supplies per week were made according to the degree of moisture of the sawdust in the sprouter. Temperatures and hygrometries were noted both in the enclosure of the basket and under shade. The average temperature inside the germiners was 28 °C; the average internal hygrometry was 94.8%. The experiment was conducted during the rainy season with average temperature and humidity of 27.6 ° C and 82.4% respectively. The crops are made under shade, and the germiners which consist of baskets, were covered by transparent plastics.

It should be noted that each explant was weighed and labeled. The explant masses of all varieties are between 0.2 kg and 1.4 kg, including both extremes. The label contained the name of the variety; the explant number, the mass and the germination date. Ten explants per variety were used; each explant was taken as a repetition. Explants were randomly placed in sawdust irrespective of mass.

Weaning was done as soon as the young plants had two to three leaves. The weaned plants were transplanted onto potting soil in the 0.5l black plastic bags. The supply of water to weaned young plants was made taking into account the weather conditions and the state of moisture of the substrate.

During the experiment, biotic parameters such as:

-the time required (in days) to get the first shoot, or Latency (TL),

- the 40-day burst rate (TD),

-the time required to wean the first shoot in each explant (TS)

-the total number of young plants weaned at 150 days after seeding in sawdust, noted as S,

-The number of days between the appearance of the first shoot and obtaining the first weaning (TS-TL)

The abiotic parameters, namely the internal temperature and hygrometry of the germiners were monitored twice a week and at 12 pm GMT.

The statistical analyzes were done using software R. The discrimination of averages was made with the Newman-Keuls test at the 5% significance level.

Percent Success (PR) of weaned and acclimatized seedlings; was calculated at 150 days after planting the explants in sawdust. The formula used is as follows:

PR(%)=(Number of live young plants/Number of weaned young plants)x 100

The burst rate (TD) is calculated as follows:

TD(%)=(Number of explants having broken at 40 days/ Total number of explants seeded)x 100

RESULTS

The results of Table 1 are obtained after an experiment which lasted five months, during the rainy season going from June to November 2016. The average temperature inside the germoirs was 28 °C; the average internal hygrometry was 94.8%. In the outdoor environment of the germoirs, the average temperature and humidity are respectively 27.6 ° C and 82.4%. The temperature variation between the inside and the outside of the germiners ranged from -1 to 4 °C. Ten explants were tested by variety, each explant constituting a repetition. The averages of the same column of Table 1 affected by the same letter are not significantly different from the Newman test and keuls at the 5% threshold.

Table 1 : Characterization of two varieties of Plantains (Kadaga and Agbavé) and two varieties of dessert bananas (Fokoma and Adokpa) compared to the PIF technique

Variety	TL (j)	TS (j)	TS-TL (j)	S (j)
Kadaga	27.1±4.38a	49.5±6.85a	22.4±8a	7.6±3.56a
Agbavé	29.8±4.75a	36.7±7.46b	6.9±3.81b	38.1±39.64b
Fokona	31.4±11.07a	44.6±13.95b	13.2±8.79b	4.1±2.23c
Adokpa	34.2±6.19b	41±6.61b	6.8±2.57b	3.1±1.85c

For TL, the difference is significant between the Kadaga and Adokpa averages ($p < 0.05$); on the other hand, the comparison between all the other means by crossing the varieties two by two; gives a nonsignificant difference (NS) with $p > 0.05$. These results prove that the Kadaga variety grows faster than the Adokpa variety. Kadaga varieties; Agbavé and Fokona grow in sawdust after about 30 days at the latest, while the Adokpa variety grows after 34 days.

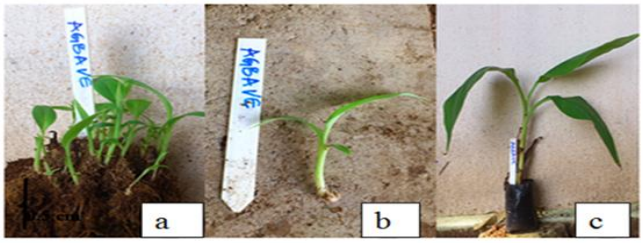

Figure 2: Variety Agbavé, a- A tuft of proliferating shoots of which about ten young plants are sevrable; b- A young plant just after weaning, not having roots; c- Aspect of a plant 120 days after weaning.

For the TS, the difference is significant between the Kadaga and Adokpa averages ($p < 0.05$), it is very significant between the Kadaga and Agbavé averages ($p < 0.01$). The comparison between all the other means by crossing the varieties two to two; gives a nonsignificant difference (NS) with $p > 0.05$. These results show that the Kadaga variety is practically 50 days in culture from sowing to weaning, while the other varieties namely Agbavé, Fokona and Adokpa are about 40 days old. The above can be explained by low growth of shoots of the Kadaga variety.

For the TS-TL, the difference is very significant between the averages of Kadaga and Agbavé ($p < 0.01$); then between Kadaga and Adokpa ($p < 0.01$). The comparison between all the other means by crossing the varieties two to two; gives a nonsignificant difference (NS) with $p > 0.05$.

These results show that the Adokpa variety can be weaned one week after the shoot while Kadaga takes three weeks to be weaned; this can be explained by the fact that the Adokpa shoots grow rapidly compared to those of Kadaga. Similarly, the Agbavé and Fokona varieties can be weaned one week after the emergence of young shoots; which is not the case at Kadaga. The size of the pseudo-trunk of the Kadaga variety would explain this long time compared to other varieties whose pseudo-trunk is tapered (Figure 3). The larger the pseudo-trunk, it takes more time to have 2 to 3 leaves which is here the criterion of withdrawal. The Kadaga variety alone takes three weeks to grow from the emergence of the shoots to weaning, while the other varieties Agbavé, Fokona and Adopkpa only make it a week to be weaned.

For S, the observation of the number of weaned plants shows that the best variety is Agbavé, with a higher number of plants weaned at 150 days after seeding, which is 38.1 ± 39.64; followed by Kadaga (7.6 ± 3.56); followed by Fokona (4.1 ± 2.23) and Adokpa (3.1 ± 1.85) (Table 1). The separation of the means by the Newman and Keuls test at the 5% threshold shows that the difference is significant between the Kadaga and Agbavé averages ($p < 0.05$). This difference is explained by the fact that the Agbavé variety is more prolific than the Kadaga variety among the plantains tested (Figure 2).

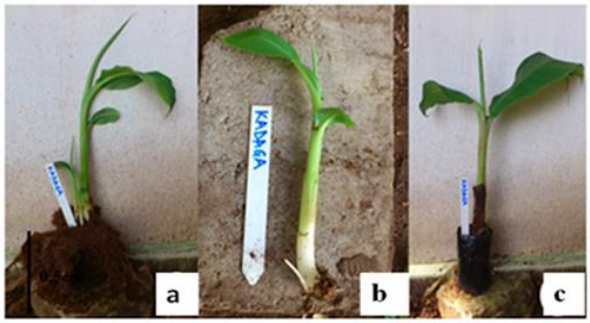

Figure 3: Kadaga variety, a-Three seedlings on a seeded explant, one of which is old enough to be weaned; b- A young plant just after weaning, with three roots; c- Aspect of a plant 120 days after weaning.

There is a large difference between the averages of weanlings in Kadaga (7.6 ± 3.56) and those in Fokona (4.1 ± 2.23) ($p < 0.01$). The above can be explained by the fact that the Kadaga variety is better than the Fokona variety with the PIF technique (Figure 3, Figure 4).

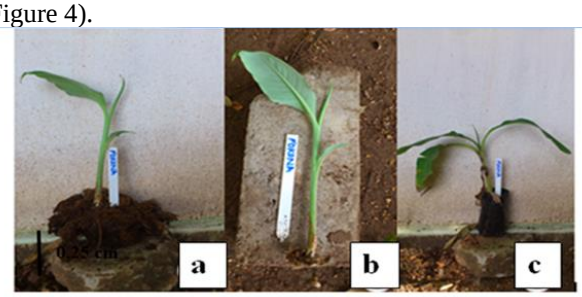

Figure 4: Fokona variety, a-A single young plant on an explant put in culture, b- A young plant just after weaning, not having roots; c- Aspect of the plant 120 days after weaning.

The number of weaned plants in Kadaga is larger than that of Adokpa ($p < 0.01$). This difference is explained by the fact that Kadaga gives more shoots by explant than the variety Adokpa during the cultivation.

The number of weaned plants in Agbavé is 10 times higher than that observed in Fokona ($p < 0.01$). This great difference can be explained by the fact that the Agbavé variety gives a multitude of shoots when weaning compared to Fokona which gives one or two plants (Figure 2, Figure 4).

The number of weaned plants at Agbavé is 13 times greater than that obtained with the Adokpa variety ($p < 0.01$). This large difference between the two varieties is explained by the fact that Agbavé is very prolific by the ratio to Adokpa (Figure 2, Figure 5).

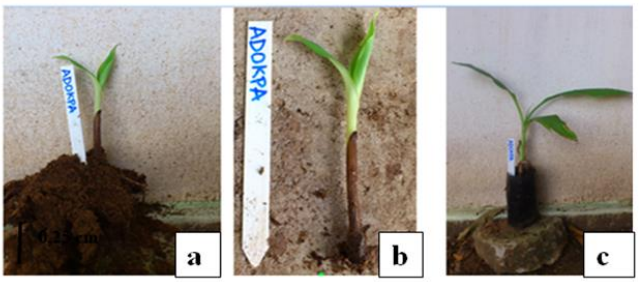

Figure 5: Adokpa variety; a-A single young plant on an explant cultivated; b- A young plant without roots just after weaning; c- Aspect of a plant 120 days after weaning.

The difference is not significant (NS) between the averages of the varieties Fokona and Adokpa; which means that the number of weanlings in Fokona is statistically equal to the number of weaned plants in Fokona ($p > 0.05$) (Figure 4, Figure 5). These results demonstrate that the two varieties of dessert banana are not very prolific with the PIF technique compared to the Agbavé and Kadaga plantains.

Table 2: Comparison of budburst rates and percentages of success plants of four banana varieties Kadaga, Agbavé, Fokona and Adokpa

Variety	Kadaga	Agbavé	Fokona	Adokpa
TD (%)	100	90	70	50
PR (%)	83.23	60.71	75.90	58

(TD: 40-day disbuldding rate or the number of explants sprouted at 40 days; PR: Success Rate of weaned plants at 150 days after seeding of explants in sawdust)

Considering the rate of bud burst, among the four varieties tested, the most successful is Kadaga with a rate of 100%; the others have a lower rate compared to this one but their rates remain greater than or equal to 50%. Kadaga remains the best variety among plantains considering this parameter, on the other hand among dessert bananas, Fokona is the best with a rate of 70%.

For the parameter success rate of vivoplants, Kadaga is also the best variety, with a success rate equal to 88.23%. She is still the best among plantains tested with the same rate. The best variety among dessert bananas is Fokona with a success rate of 75.90%.

The results can be explained by the fact that the Kadaga and Fokona varieties are better able to grow roots that are responsible for drawing nutrients into sawdust to feed the buds that will quickly emerge as seedlings. All of the above has encouraged many explants to germinate quickly, thus generating high rates in both varieties. Compared to the survival rate which remains high in both varieties (Kadaga and Fokona) unlike the others (Agbavé and Adokpa), this can be explained by the fact that during weaning, it was found that the pseudostem of Kadaga's weaning young plant is more robust than Agbavé's, which is very slender; the same goes for Fokona, whose pseudo-trunk is larger than that of Adokpa (Figure 2, Figure 3, Figure 4, Figure 5). The size of the pseudo-trunk directly induces also the size of the corm or true trunk of the weaned young plant; it should be remembered that this come is from the explant mother on which the weaning was done.

It is by the corm that water exchanges are made just after weaning between the substrate and the young plant. This absorption of water provides nutrients in the form of raw sap, which promotes the erected port of turgid young plant, leading to photosynthesis that will cause root growth thereafter. Thus, a very small come, does not offer a large surface of water absorption, which leads to the death of the young plant; all this explains the low success rates recorded at Agbavé and Adokpa (Table 2). In addition, most of the seedlings weaned from these two varieties, have no roots because they are found in the heart of the explant mother, this would explain the low success rate among them.

The delay of germination in Agbavé, Fokona and Adokpa can also be explained by the fact that the average culture temperature of 28 ° C would not be optimal to promote bursting of the explants. This state of affairs would slow down the metabolism of these varieties, which would not favor the rapid emergence of young shoots; hence their budburst rate is less than 100%.

DISCUSSION

The characterization of abiotic parameters of the germoir by Kwa in 2003 [17], showed that all temperature and hygrometry parameters measured at the germoir and outside, on the meteorological station of the African Center for Research on Banana and Plantains (CARBAP) based in Cameroon are different from each other. He showed that the highest values were recorded at the germoir because of the greenhouse effect created by the

transparent plastic. The ambient temperature in the germinator multiplication chamber was able to reach an average of 7 ° C higher than that recorded under outdoor conditions. In the dry period, increases of 6 to 8 ° C were recorded and in the rainy period they were 4 to 6 ° C. Our work is in contradiction with these results because we worked during the rainy season and the variation of temperature between the inside and the outside of the germoirs goes from -1 to 4 ° C. The great difference between the temperature fluctuations reported by Kwa [17] and those observed in our work better explains the rest of the results we had. All the above results show that the greenhouse effect was not at its maximum in our experiment. The same author has found that during its study period, the relative humidity has rarely dropped below 80% in the germinator while it has shown greater fluctuations in the meteorological station.

These results are in agreement with our results since all the hygrometries recorded during our experimentation are higher than 80%. Given the interesting results he has obtained, he concludes that the hygrometry and the average temperatures observed in the germoir seem adequate for the production of plants by the technique of BIPs in its experimental context. Indeed, he obtained a rate of bud burst superior to 90% in the varieties of Plantains French clair, French sombre, Kelongmekuitou, Bâtard, Mbourkou N ° 1; only the Great Dwarf which is a dessert banana showed a rate of bud burst equal to 10%. The results he obtained on the first five cultivars of plantains mentioned, are the same as we found on the plantains in Togo namely Kadaga and Agbavé; but these results on the dessert banana are contrary to those we found in dessert bananas namely Fokona and Adokpa which have bud break rates of 70% and 50% respectively. The latency that this author has found in all his varieties tested, ranges from 18 days to 21 days; these results are contrary to our results because in all the varieties we tested, most latency ranges from 21 days to 46 days. Most of the varieties tested by Kwa [17], have a mean number of weaned shoots per seeded fragment, ranging from 5 to 16 overall for all varieties tested; but especially among plantains, this number ranges from 7 to 16; it is five in the banana tree serving the Great Dwarf. These results are similar to those we found because the number of explant-weaned young plants in Kadaga and Agbavé Plantains is higher than those of Fokona and Adopka dessert bananas. According to this author, during the first phase of weaning, some shoots had 1 to 3 roots but others were lacking; these results are consistent with our work. He also demonstrated that the average number of shoots formed by explant was influenced by variety; this result is also consistent with our observations. The number of days between the appearance of the first shoot and the first weaning (TS-TL), ranges from 10 to 20 days in French clair and Bâtard according to research by Kwa [17], this result n It is not the same as ours, indeed this number varies according to the varieties tested, it goes from 12 to 35 days at Kadaga; 4 to 16 days at Agbavé, 3 to 24 days at Fokona and 3 to 10 days at Adokpa.

In addition to the PIF technique which makes it possible to multiply banana, it can also be multiplied by the technique of in vitro culture; but it also has advantages and disadvantages.

Indeed the number of vitro plants obtained per month in vitro reaches eight young plants per explant in the Aloga banana variety in Benin [18]. In many genotypes of Musa, a monthly multiplication rate has been reported. in vitro between 2 and 10 plants per explant [19]. In Hybrid FHIA-21, [20, 21] obtained a multiplication rate between 1 and 5 every three or four weeks. However, these values remain below those obtained by [22] in many plantain cultivars. Indeed, these authors obtained monthly multiplication rates of 12.4; 15.3; 16.5 and 20.8 respectively in cultivars Bobby Tannap, Big Ebanga, Agbagba and Ubok Iba. In addition, [23] have successfully used axillary buds for the micropropagation of plantain. These authors showed that the proliferation of axillary buds was earlier than that of shoot buds. Miilion et *al*. [24] practiced the in vitro culture technique on the Grande naine variety, and observed the highest number of shoots at 2.67 and 3 respectively at 15 and 30 days. All these results of the in vitro culture are different and at the same time better than those we obtained on the four varieties that we tested in Togo. Unfortunately, this technique is more expensive for banana farmers.

It is very simple to multiply bananas by the PIF technique compared to the in vitro culture technique (IVC); which is more elaborate, which requires more resources and knowledge of laboratory techniques, hence the advantage of adopting the PIF technique by farmers. There are similarities between the young plants obtained by the PIF technique and the vitroplants. Both multiplication techniques have explants of the same appearance; tufts of proliferation, abundant root system; the absence of parasites; and fungal and bacterial diseases. These similarities can be explained by the mode of preparation of the explant and by the conditioning linked to the culture medium. In CIV, it is the meristem sectioned after disinfection, which is cultured; in Horticultural Culture (CH) which goes through the PIF technique, the various steps followed until the destruction of the apical meristem, induce a stress necessary for the proliferation of shoots. Times of production of plants multiplied by CH, were shorter than those observed by CIV. Indeed, in 20 or 30 days of CH, many shoots able to wean were obtained while 3 to 6 months are necessary in CIV to obtain the same result. These short deadlines are particularly interesting because not only the CH uses simple, inexpensive products namely sawdust, transparent plastics, black plastic bags etc. which are accessible to producers; but it also reduces the production time of plant material that is obtained with a value for money very interesting. On the other hand, the CIV requires more laboratory products (Hormones, culture media, etc.) and energy (electricity), hence significant financial resources that are not always available to small producers. It should be noted that so far, the plants obtained by the PIF technique, have a field compliance rate of the order of 98 to 100%. The large dwarf variety (AAA dessert banana) appeared to be less able to proliferate by the PIF technique than the plantain cultivars (AAB) tested [17]. This behavior is different from that observed in vitro with cultivars of the genomic AAA group for which the multiplication rate is generally higher than for cultivars with the B gene [25].

CONCLUSION

The present work has made it possible to develop the multiplication of local cultivars of plantains, namely Kadaga and Agbavé, and the dessert bananas Fokona and Adokpa; by the technique PIF. This study made it possible to characterize these four varieties in relation to this technique. PIF is a new way of growing healthy plants. This technique is simple and requires a germoir; the proper preparation of the explant, the creation of a greenhouse effect and then the possession of a shade for the banana horticultural culture. It is possible to produce seedlings for the field in 5 months using the PIF technique. The Agbavé, Kadaga and Fokona varieties break up after at most 30 days in the rainy season except the Adokpa variety which goes beyond 34 days. The shoots are sevrable one week after their emergence in the Agbavé, Fokona and Adokpa varieties whereas those of the Kadaga variety are sevrable after three weeks. Plantain varieties Kadaga and Agbavé responded favorably to this technique on average 7 and 38 plants per explant were obtained respectively in both varieties; on

the other hand dessert bananas have not been very prolific in our growing conditions. After 5 months of experimentation, these varieties yielded on average only 4 young plants per explant seeded in Fokona and 3 young plants in Adokpa. The PIF technique can be further refined, by a better choice of the explant to be taken, of its physiological state, by the test of the different substrates namely the sawdust of the white wood and the red wood, then the rice bran. This technique can be improved by better control of proliferation cycles; by increasing the percentage of success after weaning that would be the consequence of mastering the technique of misting or the construction of tunnels suitable for acclimation. We must also see the influence of the diameter of the pseudo stem of the young weaned plant on the percentage of success. Since it is the greenhouse effect that increases the chances of proliferations, it is necessary to conduct experiments to demonstrate the effect of temperature in the rainy season and in the dry season in order to compare the results of the two seasons. To do this, it would be desirable to drive during each season, trials simultaneously under shade and open air. It is possible that the open-air tests are more prolific than those carried out under the shade. Another study may consider categorizing the masses to see if a given mass would positively influence the number of weaned young plants. Subsequent work should address these concerns in order to improve the macropropagation of bananas and plantains of Togo by PIF technique.

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