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Original article

Nitrogen fertilisation induces floriferous flush in strawberry guava (*Psidium cattleianum*)

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Abstract – Empirical observations seemed to indicate that NPK fertilisation induced a rapid floriferous flush in strawberry guava (*Psidium cattleianum*), thereby modifying its natural phenological cycle. Factors affecting the plant response to fertilisation were investigated, including: identification of the nutrient(s) responsible for the flush; and effect of the amount of fertiliser and of the plant phenological stage. Complete fertilisation was followed by the emergence of a floriferous flush 30 to 50 days after fertilisation. Nitrogen was the trigger of this flush, enhancing the proportion of flushing branches. The amount of fertiliser and the leaf nitrogen content had no effect on the flush characteristics. The phenological stage of the plant had a strong influence on the response to fertiliser, with a more intense and less variable flush when fertilisation was applied after a 3 month resting period than just after a harvest. This suggested that the carbohydrate availability within the plant was involved in the response.

***Psidium cattleianum* / nitrogen / phenology / crop cycling / Réunion Island**

Résumé – La fertilisation à l'azote induit une pousse florifère chez le goyavier-fraise (*Psidium cattleianum*). Des observations empiriques semblent indiquer qu'une fertilisation NPK induit rapidement une pousse florifère chez le goyavier-fraise (*Psidium cattleianum*), modifiant ainsi son cycle phénologique naturel. Les facteurs affectant la réponse de la plante à la fertilisation ont été étudiés : identification du (des) élément(s) minéraux responsable(s) de la pousse, effet de la quantité d'engrais et du stade phénologique de la plante. Une fertilisation complète est suivie par l'émergence d'une pousse florifère 30 à 50 jours après l'apport. L'azote est le déclencheur de cette pousse ; il augmente le pourcentage de branches émettant des pousses. La quantité d'engrais ou la teneur en azote dans les feuilles n'a pas d'effet sur les caractéristiques de la pousse. Le stade phénologique de la plante a par contre une grande influence sur la réponse à la fertilisation, avec une pousse plus intense et moins variable quand la fertilisation est apportée après une période de repos de 3 mois plutôt que juste après une récolte. Cela suggère que la disponibilité en carbone dans la plante est impliquée dans sa réponse à l'azote.

***Psidium cattleianum* / azote / phénologie / cycle de culture / île de la Réunion**

1. INTRODUCTION

The strawberry guava, *Psidium cattleianum* Sabine, is an evergreen shrub of the Myrtaceae family native to South America. It was introduced at the beginning of the 19th century to Réunion Island (Indian Ocean; lat. 21°06'S, long. 55°32'E) where it rapidly colonised the humid disturbed areas and forests, covering about 12 000 ha [19]. It has not been of agricultural importance until now.

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It is a potential new fruit species for the fresh market and processing industry in Réunion Island. Very little information about cropping techniques being available from the literature, a domestication program has been started [16] with the objective of improving yield and fruit quality by way of classical agronomic factors (tree spacing, fertilisation, pruning). There is little variability among plants [18] so that there was no need to start with a selection program.

Growing common guava, *P. guajava* L., with several production cycles each year is practised in several producing countries. The objective is to produce a regular crop throughout the year, or to shift the harvest period to a more favourable cropping season. Production cycles are triggered after harvest by pruning and/or defoliation, combined with fertilisation or rewatering after drought [9, 14, 22, 23]. However, factors affecting yield components of triggered cycles are poorly documented.

Strawberry guava phenology in natural conditions in Réunion Island consists of a single flush of floriferous shoots in October (spring), followed by flowering in December and fruit maturity from March to July depending on the elevation. No vegetative activity occurs between fruit maturity and the next floriferous flush [17]. The same phenological pattern has been described in feral thickets in Hawaii [8]. But empirical observations on strawberry guava grown in orchards in Réunion Island suggest a positive effect of complete fertilisation (NPK) on production cycle triggering.

The objective of this study was to specify the factors affecting the strawberry guava floriferous flush consecutive to fertilisation by (i) determining which nutrient(s) of the complete fertilisation is involved in the floriferous flush, (ii) quantifying the effect of increasing the amount of fertiliser on the shoot and flower emergence, and (iii) evaluating the effect of the plant phenological stage at fertilisation on the plant reaction intensity. Two experiments were conducted in strawberry guava orchards located on the humid East coast of the island (average annual rainfall = 6 700 mm) with tree spacing of 3 m (inter row) × 1 m (on the row).

2. MATERIALS AND METHODS

2.1. Determination of the nutrient(s) responsible for the induced floriferous flush

The objective of this experiment was to determine the nutrient(s) responsible for the floriferous flush observed after a complete fertilisation. It was conducted on a five and a half year-old orchard located at 480 m. Plants were grown from seed and were thus all genetically different. The last harvest was from March to May 2000 and plants had no vegetative or reproductive activity since May 2000. The last fertilisation they received was in March 1999. The following five treatments were applied on July 4th, 2000, two months after the end of the harvest. The amount of each individual nutrient was calculated to bring the same quantity of this nutrient as the complete fertilisation.

- control: no nutrient;
- NPK treatment: 240 g 15.12.24 per plant, i.e. 36 g N (13.2 g N as NO_3^- and 22.8 g N as NH_4^+); 28.8 g P_2O_5; and 57.6 g K_2O per plant;
- N treatment: 138.5 g NH_4NO_3, i.e. 36 g N, per plant;
- P treatment: 27.5 ml per plant of a H_3PO_4 85% solution (1050 g $P_2O_5 \cdot L^{-1}$) diluted in 1 L pure water, i.e. 28.8 g P_2O_5 per plant;
- K treatment: 115.2 g K_2SO_4, i.e. 57.6 g K_2O per plant.

A complete randomised block design with 4 replicates was used. The plants studied were homogeneous in size and vigour, selected on their stem section at the soil level. Each treatment was applied to 3 consecutive plants on the row, but only the central plant reaction was measured. Fertilisers were applied evenly to the ground area between the stem and the plumb of the tree edge. Regular rainfalls (146 mm during the fortnight following the application) assured a good dissolution of the nutrients and maintained the wetness of the soil. Treated plants were at a distance of at least 4 m so that there was no interaction between treatments. Fifteen 9 month-old terminal branches, identified by the dry peduncle of the fruit from the last harvest, were randomly chosen and labelled on each studied plant. The numbers of shoots and flower buds produced by the labelled branches were recorded 2.5 months after the treatment application. The number of flowers produced was recorded just before flowering.

Leaf nitrogen content was determined just before fertilisation, and then at 10, 20, 30, 40 and 50 days after fertilisation (DAF). On each plant, the second pair of leaves from the apex was collected on five, 9 month-old arbitrarily chosen terminal branches. Samples from plants receiving the same treatment in blocks 1–2 and 3–4 were mixed. Leaf samples were collected in the morning, put in plastic bags in an ice-box and brought to the laboratory for analysis. Samples were weighted and oven dried at 75 °C until weight stabilisation. Nitrogen was analysed through segmented flow analysis according to the modified Berthelot reaction after a Kjeldahl digestion without nitrate reduction [21]. Results were expressed on a leaf dry weight basis.

2.2. Amount of fertiliser and phenological stage effect on the induced floriferous flush

The objective of this experiment was to study the effect of the fertilisation date and of the amount of fertiliser on the shoots' and flowers' emergence. It was conducted on a four year-old orchard located at 520 m. The following treatments were applied:

- control: no fertilisation;
- X treatment: 18 g N per plant (120 g 15.12.24);
- 2X treatment: 36 g N per plant (240 g 15.12.24);
- 3X treatment: 54 g N per plant (360 g 15.12.24);
- 4X treatment: 72 g N per plant (480 g 15.12.24);
- 5X treatment: 90 g N per plant (600 g 15.12.24).

Treatments were applied to different plants of homogeneous size at two dates corresponding to different plant phenological stages: on April 4th, 1997, at the end of a heavy crop; and on July 24th, 1997, three months after the end of the harvest. A complete randomised block design with 4 replicates was used for each date. Each treatment was applied to a single plant per block. Fertiliser was applied as in the previous experiment. The fortnights after fertilisation were rainy (337 and 388 mm after April and July fertilisations respectively), which assured a good dissolution of the nutrients and maintained the wetness of the soil. Fertilised plants were at a distance of at least 3 m.

The numbers of shoots and flower buds were recorded as in the first experiment. For the April fertilisation, the number of flowers was not recorded, and leaf nitrogen content was measured on the plants of one block, every 10 days from fertilisation to 50 DAF, following the leaf sampling and analysis procedures described above.

2.3. Data analysis

Two complementary approaches were used to quantify the floriferous flush following fertilisation. The first one consisted of calculating the number of flowers produced from basic parameters separating the vegetative and the reproductive intensities of the flush:

$$Nbf = NbB \cdot \%FB \cdot sh/FB \cdot \%fsh \cdot fb/fsh \cdot (1–\%fbD)$$

where Nbf: number of flower produced;

NbB: number of labelled terminal branches;

%FB: proportion of flushing terminal branches, i.e. the ratio of the number of terminal branches for which at least one bud gives a new shoot on the number of labelled terminal branches, NbB;

sh/FB: number of new shoots per flushing terminal branch;

%fsh: proportion of floriferous shoots, i.e. the ratio of the number of new shoots bearing at least one flower bud to the total number of new shoots;

fb/fsh: number of flower buds per floriferous shoot;

%fbD: proportion of dropped flower buds.

These parameters were calculated from the data collected in the experiments. The treatments' effects were analysed by analysis of variance (ANOVA) on each parameter. Missing data were numerous when flushing was scarce (sh/FB, %fsh and fb/fsh do not exist when %FB is null) or not very floriferous. Then ANOVAs were performed on unbalanced data sets.

The second approach was the analysis of the treatments' effects on the total number of shoots (totsh), on the total number of floriferous shoots (totfsh) and on the total number of flower buds (totfb) produced, calculated over the 15 labelled branches per plant. It did not distinguish as clearly as previously vegetative and reproductive intensities of flushing, but provided balanced data sets for ANOVA.

One way ANOVA was performed with the S-Plus 2000 software [11] for testing the treatments' effects on the variables in each experiment. In the second experiment, ANOVAs were realised with and without the control to reveal differences between amounts of fertiliser in the latter case. Proportions were angular transformed before analysis to stabilise the variance, but untransformed means are presented in the results section. Differences between treatments were assessed using Tukey's multiple comparison test.

3. RESULTS

3.1. Determination of the nutrient(s) responsible for the induced floriferous flush

Plants which received NPK or N treatment rapidly emitted a floriferous flush after nutrients application: buds swelled at 30 DAF and burst from 50 DAF. Controls and plants which received P or K treatment had no vegetative or reproductive activity after nutrient application. Consequently, they were not considered for statistical analysis. Plant reaction following the N treatment was lower than for the NPK treatment, particularly for %FB, fb/fsh and the number of shoots, floriferous shoots and flower buds produced (Tab. I). Differences were, however, not significant.

The leaf nitrogen content in plants which received nitrogen increased from fertilisation and reached a

Table I. Characteristics (mean ± s.d.) of the strawberry guava flush consecutive to the application of 36 g N per plant (N treatment) or 240 g 15.12.24, i.e. 36 g N, per plant (NPK treatment) two months after a resting period following harvest.

Treat.	%FB	sh/FB	%fsh	fb/fsh	%fbD	totsh	totfsh	totfb
NPK	0.90±0.08	2.14±0.49	0.96±0.03	4.36±1.27	0.22±0.13	29.2±9.2	28.2±9.2	130.5±81.1
N	0.67±0.24	2.05±0.39	0.91±0.06	3.74±0.86	0.18±0.07	19.9±5.4	18.1±4.8	70.0±31.1
signif.[1]	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

[1]: n.s., non-significant.
%FB: proportion of flushing terminal branches; sh/FB: number of new shoots per flushing terminal branch; %fsh: proportion of floriferous shoots; fb/fsh: number of flower buds per floriferous shoot; %fbD: proportion of dropped flower buds; totsh: total number of shoots produced, totfsh: total number of floriferous shoots produced; totfb: total number of flower buds produced.

maximum at 20 DAF whereas that in plants which did not received nitrogen slightly decreased. Then it steeply decreased for all treatments between 20 and 30 DAF and increased from 30 to 50 DAF (Fig. 1). The nitrogen application (NPK and N treatments) induced a significantly higher leaf nitrogen content from 20 to 50 DAF.

3.2. Amount of fertiliser and phenological stage effect on the induced floriferous flush

The April 1997 fertilisation, just after harvest, induced a rapid plant growth. Non-fertilised controls also showed a slight growth. Buds swelled after 20 DAF and burst from 30 to 50 DAF. The flush was weak and not very floriferous irrespective of the amount of fertiliser (Tab. II). For a given treatment, the variability in plant response was high, particularly for variables related to the floriferous status of the shoots. In spite of marked differences between means, differences between treatments were not significant. The proportion of flushing branches, %FB, was low on control and increased with the amount of fertiliser. Highly significant differences occurred between control and 4X and 5X treatments. Differences in the total number of shoots produced, totsh, were related to the differences in %FB as sh/FB was not affected by treatments. The other parameters were not significantly affected by the treatments. No floriferous shoot was observed on the control and on the X treatment. ANOVA without the control gave non-significant differences between amounts of fertiliser for all parameters. There was a tendency of increasing %FB means with the amount of fertiliser.

No significant correlation was found between the leaf nitrogen content at 0, 10, 20 or 30 DAF and the parameters of the plant response (data not presented). Correlations with leaf nitrogen content at 40 and 50 DAF were not tested as bud burst had occurred by this time,

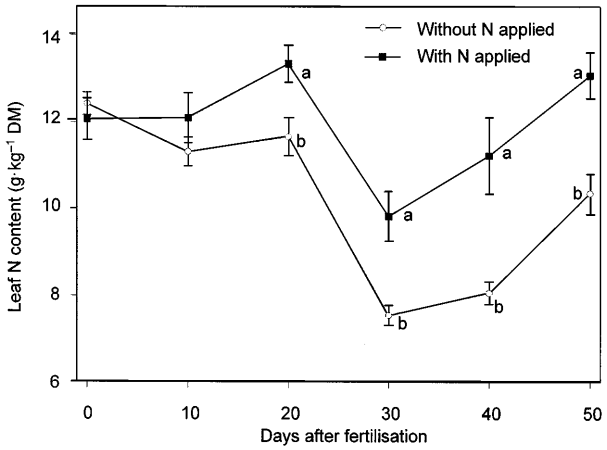

Figure 1. The effect of fertilisation on the leaf nitrogen content of strawberry guava. Plants which received nitrogen (NPK – 36 g N; 28.8 g P_2O_5; 57.6 g K_2O per plant- and N – 36 g N per plant- treatments) are separated from plants which received no nitrogen (non-fertilised control, P – 28.8 g P_2O_5 per plant-, and K – 57.6 g K_2O per plant- treatments). Vertical bars indicate standard error of each mean. For each date, means with different letters are significantly different (Tukey's test at $P = 0.05$).

and the number of shoots and flower buds were already fixed.

There was no relation between the amount of nitrogen applied in April 1997 and the leaf nitrogen content during the 50 DAF. Consequently, data of X to 5X treatments were pooled and compared with the leaf nitrogen content of the control (Fig. 2). Changes in the leaf nitrogen content of control and fertilised plants had the same pattern, but values were higher in fertilised plants from 10 DAF, indicating a rapid uptake of nitrogen. The maximum leaf nitrogen content was reached at 20 DAF, followed by a slow decrease up to 50 DAF. Leaf nitrogen content of control and fertilised plants was higher than in the first experiment.

Table II. Characteristics (mean ± s.d.) of the strawberry guava flush consecutive to the application of different amounts of NPK fertiliser (X to 5X treatments) or without fertilisation (control) at the end of harvest in April 1997. ANOVA results are first presented including all the treatments, and then without the control to test the effect of the amount of fertiliser.

Treat.	N applied (g per plant)	%FB	sh/FB	%fsh	fb/fsh	totsh	totfsh	totfb
control	0	0.07±0.08 b	1.75±0.35	0	–	1.7±2.1 b	0	0
X	18	0.22±0.23 ab	1.89±0.19	0	–	6.2±6.8 ab	0	0
2X	36	0.58±0.24 ab	1.81±0.30	0.08±0.10	2.41±2.00	16.5±9.3 ab	1.7±2.9	6.0±11.3
3X	54	0.35±0.35 ab	1.64±0.50	0.17±0.33	3.05[1]	9.5±11.7 ab	4.5±9.0	13.7±27.5
4X	72	0.73±0.24 a	2.09±0.18	0.18±0.22	3.78±1.07	23.2±8.8 a	4.7±4.7	16.0±16.5
5X	90	0.72±0.26 a	1.78±0.36	0.16±0.19	1.78±0.95	20.0±10.1 ab	3.0±2.6	6.2±7.6
mean	–	0.44	1.83	0.11	2.73	12.9	2.3	7.0
signif.[2]	–	**	n.s.	n.s.	n.s.	*	n.s.	n.s.
Without the control:								
mean	–	0.52	1.84	0.24	2.73	15.1	2.80	8.40
signif.[2]	–	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

[1]: n = 1 value, s.d. is not calculated.
[2]: signif.: n.s.: non-significant; *, **: significant respectively at P=0.05 and P=0.01. Means followed by different letters are significantly different (Tukey's multiple comparison test).
%FB: proportion of flushing terminal branches; sh/FB: number of new shoots per flushing terminal branch; %fsh: proportion of floriferous shoots; fb/fsh: number of flower buds per floriferous shoot; totsh: total number of shoots produced, totfsh: total number of floriferous shoots produced; totfb: total number of flower buds produced.

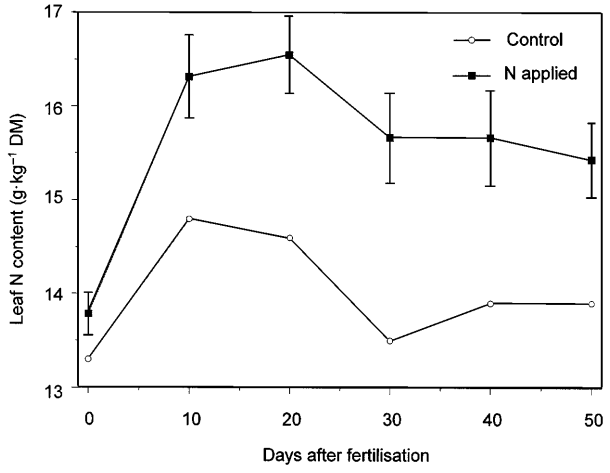

Figure 2. The effect of fertilisation on the leaf nitrogen content of strawberry guavas fertilised with different amounts of complete fertiliser in April 1997. Plants which received nitrogen (18, 36, 54, 72 and 90 g N per plant) were pooled and the vertical bars indicate the standard error of mean. The control plant was not fertilised.

The July 1997 fertilisation, after a 3 month resting period following harvest, induced a rapid plant growth. Buds swelled at 30 DAF and burst from 50 DAF. The flush was intense and floriferous (Tab. III). A slight flushing activity was observed on the control. For a given treatment, the variability of plant response was lower than after the fertilisation of April 1997. The fertilised plants all had a high proportion of flushing branches, %FB, significantly higher than for the control. A high variability in %FB was observed in this latter. The number of new shoots per flushing branch (sh/FB) was lower for the control and increased with amounts of fertiliser. It was significantly different between the control and the 5X treatment. Almost all shoots were floriferous, whatever the presence or absence and the amount of fertiliser. The number of flower buds per floriferous shoot (fb/fsh) was lower for the control and increased by 1 to almost 2 units on fertilised plants, with significant differences between the extreme mean values (control and 4X treatment). The proportion of dropped flower buds (%fbD) was not affected by the presence or absence and the amount of fertiliser. Highly significant differences were found on totsh, totfsh and totfb between the control and the fertilised plants. They resulted from the differences in %FB as this parameter was then multiplied by parameters unaffected or slightly affected by treatments. The number of shoots, floriferous shoots and flower buds produced increased with the amount of fertiliser, but differences were not significant.

Table III. Characteristics (mean ± s.d.) of the strawberry guava flush consecutive to the application of different amounts of NPK fertiliser (X to 5X treatments) or without fertilisation (control) in July 1997, after a 3 month resting period following harvest. ANOVA results are first presented including all the treatments, and then without the control to test the effect of the amount of fertiliser.

Treat.	N applied (g per plant)	%FB	sh/FB	%fsh	fb/fsh	%fbD	totsh	totfsh	totfb
control	0	0.33±0.30 b	2.07±0.12 b	0.98±0.03	5.02±1.32 b	0.04±0.05	10.2±9.1 b	10.0±8.7 b	47.5±36.6 b
X	18	0.97±0.07 a	2.38±0.18 ab	1.00±0.00	6.21±0.78 ab	0.10±0.07	34.5±2.4 a	34.5±2.4 a	214.7±33.7 a
2X	36	0.98±0.03 a	2.37±0.15 ab	1.00±0.00	6.39±0.47 ab	0.13±0.04	35.0±3.2 a	35.0±3.2 a	223.5±22.2 a
3X	54	0.98±0.03 a	2.64±0.49 ab	1.00±0.00	6.45±0.28 ab	0.12±0.04	39.0±8.2 a	39.0±8.2 a	253.2±57.1 a
4X	72	0.98±0.03 a	2.79±0.30 ab	1.00±0.00	6.92±0.62 a	0.08±0.01	41.2±5.4 a	41.2±5.4 a	286.7±53.3 a
5X	90	0.96±0.07 a	3.00±0.47 a	0.99±0.01	6.57±0.61 ab	0.14±0.13	43.2±6.1 a	43.0±6.4 a	282.7±52.8 a
mean	–	0.87	2.56	1.00	6.13	0.10	33.9	33.8	218.1
signif.[1]	–	***	*	n.s.	*	n.s.	***	***	***
Without the control:									
mean	–	0.98	2.64	1.00	6.51	0.11	38.6	38.5	252.2
signif.[1]	–	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

[1]: signif.: n.s.: non-significant; *, ***: significant respectively at P=0.05 and P=0.001. Means followed by different letters are significantly different (Tukey's multiple comparison test).
%FB: proportion of flushing terminal branches; sh/FB: number of new shoots per flushing terminal branch; %fsh: proportion of floriferous shoots; fb/fsh: number of flower buds per floriferous shoot; %fbD: proportion of dropped flower buds; totsh: total number of shoots produced, totfsh: total number of floriferous shoots produced; totfb: total number of flower buds produced.

4. DISCUSSION

4.1. Nutrient(s) responsible for the floriferous flush induced by fertilisation

The results of both experiments clearly illustrate the rapid emergence of a floriferous flush after a complete fertilisation of strawberry guava. Fertilisation, therefore, modifies the natural phenological cycle of strawberry guava in Réunion Island by triggering a production cycle.

Nitrogen was the nutrient involved in the emergence of a floriferous flush following a complete fertilisation. In the first experiment, the plant reaction was observed only on plants which received nitrogen (NPK and N treatments). Phosphorus and potassium were not involved as nutrients. The number of shoots and flower buds formed with a pure nitrogen application or with a complete fertilisation were not significantly different. This suggests that no interaction occurs between nitrogen and other nutrients on the shoot emergence. Nitrogen stimulates the growth of strawberry guava with the proportion of flushing branches as the most affected parameter.

The amount of fertiliser, and thus of nitrogen, has no significant effect on the induced flush, whatever the strawberry guava phenological stage at the fertilisation date. In particular, there is no relation between the leaf nitrogen content from fertilisation to bud swell and the plant response parameters, suggesting that factors other than leaf nitrogen content are involved in the vegetative and reproductive intensity of the plant response.

4.2. Effect of the plant phenological stage at fertilisation

The plant phenological stage when fertilisation was applied had a strong effect on the plant response. When fertilisation was applied in April, just after harvest, the induced flush was weak and produced few flowers, and the variability in the response was high. When fertilisation was applied in July, after a 3 month resting period following harvest, the induced flush was intense and floriferous, and the variability in plant reaction was low. These differences could be related to the plant phenological stage when fertilisation was applied, or to climatic factors such as temperature, water availability or photoperiod, which could enhance shoot or flower initiation. Elevation, and consequently the temperature, has no clear effect on the strawberry guava growth [17]. Minimum monthly rainfall during the experiments was 222 mm and the soil was always wet. Moreover, strawberry guava is not a photoperiodic species for growth [2]. It appears therefore that the differences in the flush characteristics were related to the plant phenological stage when fertilisation was applied.

Our results support the hypothesis that the characteristics of the flush triggered by nitrogen are in relation to the carbohydrate availability. On one hand, carbohydrate

availability changes in fruit trees during the year with respect to the phenological stages [10, 20, 24]. On the other hand, relations between the carbohydrate availability and shoot or flower bud formation are documented for several fruit tree species [3, 7, 25]. Growing strawberry guava fruit are strong sinks for carbohydrates: a study of the dry matter balance done on 3 plants of the orchard of the second experiment during the 1997 fruiting period indicated that immature fruit bore about 25% of the total plant dry weight, 2 months before harvest (unpublished data). We can consequently suspect a low carbohydrate availability at harvest, as in avocado [20], tangerine [10] or mango [24]. Plant carbohydrate level is conditioned by the reserves, the leaf area and the fruit load. It is, therefore, related to the source-sink balance at the tree level, hence probably the strong variability in plant reaction when fertilisation was applied during or just after harvest. Carbohydrate levels are restored after harvest in different fruit species [10, 20, 24]. Higher carbohydrate levels in the plant probably led to the intense and floriferous flush consecutive to a fertilisation after a 3 month resting period. The variability was lower as the differences in plant carbohydrate level induced by the fruit load had vanished and all plants were supposed to have recovered a normal carbohydrate level. Under this hypothesis, shoot and flower bud formation appears to be sensitive to carbohydrate availability and strawberry guava behaves as an alternate bearing species when floriferous flushes are triggered with nitrogen [13].

Although significant difference occurred only between the control and the 4X treatment, the number of flower buds per floriferous shoot was higher on the fertilised plants than on the non-fertilised plants when fertilisation was applied after a resting period (Tab. III). This suggests that fertilisation stimulated the flower bud formation. This stimulation was rapid after the fertilisation as flower buds were formed and visible when the buds burst and the new shoots began to elongate 4 to 6 weeks after fertilisation, depending on the temperature. There is often a good correlation between leaf nitrogen content and leaf photosynthetic rate in fruit trees such as peach [5] or apple [4] and in herbaceous species [6, 12, 15]. Assuming such a relation in strawberry guava, the higher leaf nitrogen content after fertilisation could lead to a higher carbohydrate availability in fertilised plants. The higher number of flower buds in fertilised plants, particularly when high amounts of nitrogen were applied after a resting period, could be in relation to these changes in carbohydrate availability [1, 7].

4.3. Agronomic consequences

The possibility of triggering production cycles by nitrogen has interesting agronomic consequences as cycles could be superimposed on the plants. Two to three harvests are possible on the same plant in a year, which would increase the annual yield (unpublished data). Triggering dates could be chosen to harvest fruit with respect to the market demand or during the cooler season when fruit fly populations are low and fruit quality is better. Nitrogen fertilisation programmes must, therefore, be adapted to the growth cycle of strawberry guava. The cycles are easier to trigger than in guava cultivation where a combination of pruning/defoliation and fertilisation is needed [9, 14, 22, 23]. However, the suspected dependence of the plant response on carbohydrate availability is a limitation that should be taken into account. To our knowledge, this aspect has not been found for common guava.

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