PRUNING CYCLES AND NITROGEN FERTILIZATION OF COFFEE FIELDS CONDUCTED IN THE "SAFRA ZERO" SYSTEM

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(Recebido: 14 de abril de 2009; aceito: 13 de agosto de 2009)

ABSTRACT: Modern, competitive and cost effective coffee production requires plants with high productivity that are more adapted to mechanical and manual harvesting. "Safra Zero" is a cultivation system designed to limit plant height and eliminate the need for expensive harvesting during years of low productivity, which usually follow years of high productivity. This system is based on pruning cycles, nitrogen fertilization and different management methods. To evaluate the "Safra Zero" system, the following experiments were conducted in coffee fields (*Coffea arabica* L.) at the Procafé/MAPA Experimental Station, in Varginha, Minas Gerais state: i) Evaluation of different pruning cycles in short plants; ii) Evaluation of different pruning cycles in tall plants. Rejuvenation pruning, in which all the primary branches were cut-back severely (parrot-perching), was done in alternate years, every four years, to evaluate mean productivity. iii) Evaluation of the pruning management every two years, associated with the application of different nitrogen doses (0, 200 and 400 kg.ha^{-1}.year^{-1}). The different pruning cycles did not result in yield gain, compared to the control plants (without pruning). The use of different nitrogen levels after pruning, in a coffee field grown on soils with high organic matter content and traditionally fertilized with 350 kg of N per hectare per year, did not improve yield, with or without pruning.

Key words: *Coffea arabica*, crop management, nutrition.

CICLOS DE PODA E ADUBAÇÃO NITROGENADA EM LAVOURAS CAFEEIRAS CONDUZIDAS NO SISTEMA "SAFRA ZERO"

RESUMO: *Na cafeicultura moderna e competitiva, é essencial o uso de plantas que sejam produtivas e com facilidade de colheita, seja via mecânica, seja manual, tendo em vista a diminuição de custos. O "Safra Zero" é um sistema de condução de lavoura que tem por finalidade manter a lavoura com porte baixo e eliminar a necessidade de colheitas onerosas no ano de baixa safra que, normalmente, ocorre após um ano de alta safra. Esse sistema baseia-se em podas constantes, adubações e manejos diferenciados. Para avaliar o sistema "Safra Zero" de manejo em lavouras cafeeiras (Coffea arabica L.), foram instalados os seguintes experimentos na Fazenda Experimental da Fundação Procafé/Mapa de Varginha: i) Avaliação de diferentes ciclos de podas em lavouras de porte alto; ii) Avaliação de diferentes ciclos de poda em lavouras de porte baixo. As podas do tipo decote e/ou esqueletamento foram aplicadas em anos alternados e a cada quatro anos, para avaliar a produtividade média. iii) Avaliação do manejo de podas a cada dois anos, associado à aplicação de diferentes doses de nitrogênio (0, 200 e 400 kg.ha^{-1}.ano^{-1}). A utilização de diferentes ciclos de podas não resultou em ganho de produção em relação à testemunha sem poda. A utilização de diferentes níveis de nitrogênio após a poda, em lavoura implantada em solo com alto teor de matéria orgânica e com histórico de adubação em torno de 350 kg de N por hectare por ano, não resultou em diferenças significativas para a melhor recuperação e aumento da produtividade da lavoura.*

Palavras-chave: Coffea arabica, manejo de lavoura, nutrição.

1 INTRODUCTION

To improve harvesting, usually one of the milestones of profitable coffee production, the "Safra Zero" system was designed. This management system is based on coffee's biennial yield pattern and pruning cycles following years of high productivity. Between these periods of enhanced productivity all productive branches are pruned 30 to 40 cm from the orthotropic branch, resulting in new shoots which will be productive in two years time. During this period, the producer stimulates the growth of these new

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branches to obtain the highest possible yield in this first harvest, maintaining a good mean productivity even when harvesting is not done in alternate years. This is fundamental as, even in mechanical harvesting, but especially in manual harvesting where labor is widely used, it reduces costs and eliminates the need for ladders, which raise harvesting costs and are time consuming.

As there is still little information available on nitrogen fertilization in the "Safra Zero" system, three experiments were set up to study the system and its combinations in coffee crops (*Coffea arabica* L.) in the southern region of Minas Gerais state, Brazil. The aim of these experiments was to determine pruning periods, nitrogen fertilization periods and the amount of nitrogen supplied.

2 MATERIAL AND METHODS

Experiment 1: Pruning cycles in tall coffee crops

The experiment set up at the Procafé/Mapa Foundation's experimental farm in the municipality of Varginha, south of Minas Gerais state, from 2003 to 2007. A seven year old Mundo Novo IAC 376/4 crop, in a 4,0 x 1,0 m spacing, 3,0 m tall and with high vigor was selected for application of the treatments.

The experimental design was a randomized block with six treatments, four replications and ten trees per plot (of which the central eight were used). Viana et al. (2000), assessing the optimum plot size for experiments with coffee (*Coffea arabica* L.), concluded that, according to the "maximum curve" method, the ideal plot in assessments of cherry coffee should have six trees or $16{,}8m^2$, while in the variation comparison method, the ideal plot should have 3 trees or $8{,}4m^2$.

The treatments (Table 1) began in September 2003, soon after harvesting, and consisted of: pruning of the canopy top of the tree at 2,0m and pruning of all productive branches 30 cm from the orthotropic branch (treatments 2 and 3); pruning the canopy top at 1,4m and pruning of all productive branches (treatment 4); pruning of all productive branches at 2,0m (treatment 5) and pruning of all productive branches at 2,0m plus pruning at the end of the branch 70 cm from the orthotropic branch (treatment 6). Pruning was done with a chainsaw, soon after harvesting. Nitrogen fertilization was done through three annual applications of urea in October/ November, December and February, according to the years with and without grain production in each treatment.

The remaining nutrients were supplied according to the demands estimated in soil analysis (Guimarães et al. (1999).

Rust was controlled in the same way in all the treatments, only in the years without harvesting, through two pulverizations with 50% copper oxichloride and 30 $kg.ha^{-1}$ of systemic soil insecticide/ fungicide (disulfoton and triadimenol).

Harvesting was done each year by marking out the area of the central plants, followed by total fruit harvest and gathering of the fruits on the ground. The useful plot was measured in liters/plot, converted later into $sacks.ha^{-1}$, and included in a harvest results table.

Production in 2004, 2005, 2006, 2007, and the mean production between 2004 and 2007, was assessed, after completion of at least one full pruning cycle in each treatment. Statistical analysis was done by the Sisvar program (Variation Analysis System), version 4.0 (FERREIRA, 2000). The significance level was 5% probability and the treatment means were compared through the Scott-Knott test.

Experiment 2: Pruning cycles in short coffee crops

The experiment was set up at the Procafé/ Mapa Foundation's experimental farm in the municipality Varginha, Minas Gerais state, from 2003 to 2008. A seven year old Catuaí Vermelho IAC 144 crop, in a 3,8 x 0,8m spacing, 2,5 m tall and with high vigor was selected for application of the treatments.

The experimental design was in randomized blocks with four replications and 12 trees per plot, of which the central eight were used. Pruning of all productive branches was done on the plagiotropic branches 30 cm from the trunk, while pruning of the canopy top was done by cutting the top of the coffee tree in a bevel shape 1,8 m from the ground. Pruning was done with a chainsaw following harvesting. The treatments were applied according to Table 2.

The remaining nutrients were supplied according to the demands estimated in soil analysis (Guimarães et al. (1999).

Rust was controlled in the same way in all the treatments, only in the years without harvest, through two applications of 50% copper oxichloride and 30 kg.ha^{-1} of systemic soil insecticide/fungicide (disulfoton and triadimenol).

Nitrogen fertilization was done in October/ November, December and February, according to the years with and without grain production in each treatment.

Harvesting was done each year by marking out the area of the central plants, followed by total fruit harvest and gathering of the fruits on the ground. The useful plot was measured in liters/plot, converted later into sacks.ha^{-1}, and included in a harvest results table.

Production in 2004, 2005, 2006, 2007, and the mean production between 2004 and 2007 was assessed after completion of at least one full pruning cycle in each treatment.

Statistical analysis was done by the Sisvar program (Variation Analysis System), version 4.0 (FERREIRA, 2000). The significance level was 5% probability and the treatment means were compared through the Scott-Knott test.

Experiment 3: Nitrogen fertilization levels in tall coffee crops subjected to the “Safra Zero” system

The experiment was set up at the Procafé/ Mapa Foundation’s experimental farm in the municipality of Varginha, Minas Gerais state, from 2003 to 2008. A seven year old Acaiá IAC 474/19 crop, in a 3,8 x 0,8m spacing, 2,5 m tall and with high vigor was selected for application of the treatments.

The experiment consisted of nine treatments with four replications in a randomized block design with ten trees per plot, of which the central 8 were used.

Table 1 – Treatments of the Mundo Novo IAC 376/4 cultivar’s pruning cycles. Varginha, Minas Gerais state. 2009.

Treat	2003/2004		2004/2005		2005/2006		2006/2007	
	Pruning	Kg N.ha^{-1}	Pruning	Kg N.ha^{-1}	Pruning	Kg N.ha^{-1}	Pruning	Kg N.ha^{-1}
1	-	300	-	300	-	300	-	300
2	E + D	400	-	200	E + D	400	-	200
3	E + D	400	-	300	-	200	-	200
4	E + Db	400	-	300	-	300	-	200
5	D	300	-	300	-	300	-	300
6	D + Dp	400	-	200	D + Dp	400	-	200

E – pruning of all productive branches, D – pruning of the canopy top of the tree (2,0 m), Db – pruning of the canopy top of the tree (1,4 m), Dp – pruning at the end of the branch

Table 2 – Treatments of the Catuaí Vermelho IAC 144 cultivar’s pruning cycles. Varginha, Minas Gerais state. 2009.

Treat	2003/2004		2004/2005		2005/2006		2006/2007	
	Pruning	Kg N.ha^{-1}	Pruning	Kg N.ha^{-1}	Pruning	Kg N.ha^{-1}	Pruning	Kg N.ha^{-1}
1	-	300	-	300	-	300	-	300
2	E + D	400	-	200	E + D	400	-	200
3	E + D	400	-	300	-	200	-	200
4	D	300	-	300	-	300	-	300

E – pruning of all productive branches, D – pruning of the canopy top (1,8m)

Table 3 – Nitrogen fertilization of an Acaiá IAC 474/19 tall crop subjected to pruning of all productive branches and pruning of the canopy top at 2,0 m. Varginha, Minas Gerais state. 2009.

Treatment	N ($kg.ha^{-1}.ano^{-1}$)	
	Year of high productivity	Year of low productivity
1	0	0
2	0	200
3	0	400
4	200	0
5	200	200
6	200	400
7	400	0
8	400	200
9	400	400

The remaining nutrients were supplied according to the demands estimated in soil analysis (Guimarães et al. (1999).

Rust was controlled in the same way in all the treatments, only in the years without harvesting, through two applications of 50% copper oxichloride and 30 $kg.ha^{-1}$ of systemic soil insecticide/fungicide (disulfoton and triadimenol).

The treatments began in September 2003, following a year of high productivity. Pruning of the canopy top in a bevel shape was done at 2,0 m and pruning of all productive branches was done 30 cm from the orthotropic branch, with a chainsaw, in treatments 1, 2, 3, 4, 5, 6, 7, 8 and 9. Pruning was repeated in September 2005, soon after harvesting. Nitrogen fertilization was done annually in October/ November, December and February with urea, according to the years with and without grain production in each treatment.

Harvesting was done each year by marking out the area of the central plants, followed by total fruit harvest and gathering of the fruits on the ground. The useful plot was measured in liters/plot, converted later into $sacks.ha^{-1}$, and introduced in a harvest results table.

Yield, leaf nitrogen concentration and vegetative growth were assessed in 2005 and 2007.

The experimental design was in randomized blocks. Statistical analysis was done by the Sisvar program (Variation Analysis System), version 4.0 (FERREIRA, 2000). The significance level was 5% probability and the treatment means were compared by the Scott-Knott test.

3 RESULTS AND DISCUSSION

3.1 Pruning cycles in a tall coffee crop

There was a significant statistical difference between the Mundo Novo IAC 376/4 treatments in all the harvest years in this experiment (2004 to 2007).

In 2004 the crop presented a low yield, as the control without pruning treatment produced 23,7 $sacks.ha^{-1}$ (Table 4) and the other treatments, recently pruned, were not productive at all. In 2005, the trees subjected to pruning of all productive branches and pruning of the canopy top at 2,0 m (treatments 2 and 3) and pruning of the canopy top at 2,0 m associated with pruning of the end of the branches (treatment 6), presented similar mean yields, inferior only to control (105,28 $sacks.ha^{-1}$ yield). The trees subjected to a lower pruning of the canopy top at 1,4 m (treatment 4), and only to pruning of the canopy top (treatment 5), presented the lowest mean yields. In 2006, coffee's biennial production pattern led to a control treatment yield of 19,50 sacks per hectare. At the end of the experimental period (2003 to 2007), the control without pruning and treatments consisting of pruning of all productive branches associated with pruning of the canopy top at 2,0 m, every two or four years (treatments 2 and 3), presented the highest mean yields, which distinguished them from the remaining treatments (Table 4). This is due to a renewal of the trees' aerial part. In treatment 3, the renewed aerial part was productive for a longer period of time (3 harvests), and this contributed to its higher mean yield (45,80 $sacks.ha^{-1}$).

In the plants subjected to pruning of all productive branches and pruning of the canopy top at 1,4m (treatment 4), only to pruning of the canopy top (treatment 5) and pruning of the canopy associated to pruning at the end of the branches (treatment 6), pruning did not favor a broader renewal of the aerial part. However, Matiello et al. (2005) affirm that a lighter pruning results in a better productivity response in coffee. According to the authors, pruning of the canopy top is more efficient than of the productive branches and the type of pruning that least affects production requires the least cutting of the plant. Coffee productivity decreases from control to pruning of the canopy, pruning of productive branches and pruning at the end of the branches. The authors assessed pruning systems with and without planting of double rows in six harvests.

Pruning, in general, does not enhance productivity. Toledo & Barros (1999) observed, after 17 harvests, that implementation of a pruning system in coffee crops managed without pruning, pruned at the canopy top at 2,0 m and pruned at the end of the branches in a predetermined scheme (Beaumont & Fukunaga), in which low pruning is done in 20% of the area each year in groupings of five lines, did not influence yield.

Barros et al. (2000) found that, after four harvests, pruning of the canopy top and the end of the branches was 36% inferior to the treatment without pruning, but presented a gain of 18% in relation to the total low pruning done in the same period. The authors also found that the best performance, until the fifth harvest, occurred when pruning was not done.

Matiello et al. (2006) affirm that, after three harvests, pruning of all productive branches does not offer productivity advantages in coffee. According to the authors, a higher frequency pruning of these branches means a proportionally lower yield and pruning every three years leads to a better response than pruning every two years. In this experiment, although the Mundo Novo IAC 376/4 crop, in 2003, was over 2,5 m tall, it was still vigorous and did not present loss of the lower canopy; therefore it was a productive crop, but still ideal for implementation of the Safra Zero system. This may explain the control treatment's high mean yield, as the crop did not require pruning.

In treatment 3, in which mean productivity was similar to control, pruning compensated the crop's biennial production pattern (Table 4). This is extremely important as, in 2006, although production costs were not assessed, the low yield of the control treatment (19,50 sacks.ha^{-1}) contributed an increase of the cost of each sack produced. Therefore, in Mundo Novo IAC 376/4 trees, pruning of productive branches associated to pruning at the end of the branches can enhance the producer's profitability.

3.2 Pruning cycles in short coffee crops

Except in 2005, in all the harvest years there was a significant difference between the pruning cycles in the short Catuaí Vermelho IAC 144 coffee crop.

Table 4 – Yield of the Mundo Novo IAC 376/4 crop subjected to pruning cycles between 2003 and 2007. Varginha, Minas Gerais state. 2009.

Treatments	Yield (sacks.ha^{-1})				
	2004	2005	2006	2007	Mean 04-07
1- Control without pruning	23,7 a	105,28 a	19,50 c	47,10 c	48,90 a
2- Pruning productive branches + pruning canopy top every 2 years	0,0 b	74,05 b	0,00 d	94,18 a	42,05 a
3- Pruning productive branches + pruning canopy top every 4 years	0,0 b	78,00 b	55,05 b	50,10 c	45,80 a
4- Pruning productive branches + low pruning canopy top every 4 years	0,0 b	50,00 c	72,75a	24,85 d	36,93 b
5- Pruning canopy top every 4 years	0,0 b	64,35 c	47,82 b	44,45 c	39,15 b
6- Pruning canopy top + pruning end of the branch every 2 years	0,0 b	75,75 b	0,00 d	69,32 b	36,30 b
CV%	24,53	11,54	17,85	20,24	9,32

Means followed by the same letter in the column did not differ in the Scott-Knott test (5% probability level).

At the end of the pruning cycle (2003 to 2007), in the Catuaí Vermelho IAC 144 crop the control without pruning treatment presented the highest productivity means (Table 5). Catuaí is a cultivar little responsive to pruning. In 2005, it was observed that the yield of the pruned crops were similar to the control which, due to coffee's biennial characteristics, would be a year of low productivity. The Catuaí crop did not present a higher yield in 2006 and 2007, confirming that pruning is not suited to Catuaí Vermelho IAC 144 coffee.

In 2003, the Catuaí Vermelho IAC 144 crop was approximately 1,8 m tall, vigorous, did not present loss of the lower canopy and had a high productive capacity. This made it adequate to the Safra Zero system. The high vigor led to the control treatment's high mean yield. According to Matiello et al. (2004), in Catuaí Vermelho IAC 44 densed crops subjected to pruning at the end of the branches or at the canopy top or to elimination of the lines, the decrease in plant yield was proportionally higher the earlier and the more drastic the pruning.

Catuaí is known to be a cultivar little responsive to pruning. Santinato et al. (2006) observed that more drastic pruning leads to proportionally higher productivity losses. According to Matiello et al. (2003a), in a 15 year old Catuaí crop, in a 3,5 x 1,5 m spacing, in which four types of pruning were done (pruning at the end of the branches, pruning of all productive branches, pruning of the canopy top and pull-off), four years after pruning there was a higher accumulated production in the control treatment without pruning, followed by treatments with pruning of all productive branches, pruning of the canopy top and pruning at the end of the branches. Matiello et al. (2003b), studying the costs of four harvests in two 130 ha properties (one producing *C. arabica* and the other *Coffea canephora* Pierre ex A. Froehner), observed that coffee's production cycle (high and low productivity) influenced production costs, especially of arabica, in which, during years of low productivity (mean of 21 sacks per hectare) the estimated cost of each sack was R$175,00. In the years of high productivity (mean of 62 sacks per hectare) the mean sack cost was R$97,00.

Pruning aims at optimizing labor use in coffee fields and at reducing costs, especially in harvesting, which are the main determining factors of the final cost of each coffee sack. In both experiments, during the four harvests assessed, pruning did not enhance productivity. However, it is important to highlight that pruning was done to avoid the need for harvesting in the low productivity years and, in this way, reduce production costs. According to Barros et. al (2005), harvesting represents between 25 to 35% of the direct coffee production costs and employs more labor than any other phase of the crop's production cycle. This is why it is such as important phase for cost reduction. According to the Procafé Foundation (2009), coffee production costs are heavily influenced by crop yield. Therefore, a lower yield means a higher cost per coffee sack. In terms of production ranges per hectare, the cost per processed sack, in 2008, varied from R$397,00, for a yield of 10 sacks.ha^{-1}, to R$235,00 for a yield of 40 sacks.ha^{-1}. In the harvesting processes alone, costs ranged from R$ 158,58/sack for 10 sacks.ha^{-1} to R$ 84,76 for 40 sacks.ha^{-1}, demonstrating the necessity of stimulating greater harvests to reduce costs. These results are corroborated by Barros et al. (2004), who found a cost of R$25,00 per sack of densed coffee (2,0 x 1,0 m), harvested every two years in the Safra Zero system in the Zona da Mata region of Minas Gerais state, and which had a mean yield of 80 sacks.ha^{1}. Meanwhile, in the traditional harvesting system in the same crop (mean yield of 40 sacks.ha^{-1}/year), the cost of the sack was estimated at R$45,00. On the other hand, only in 2006, the yield of treatments 3 and 4 was higher than the control treatment, which would probably not justify the application of these pruning practices in a Catuaí Vermelho IAC 144 crop. The mean yields of all the treatments in the four years assessed were lower than the control treatment yield.

3.3 Nitrogen fertilization levels in a tall coffee crop subjected to the Safra Zero system

Nitrogen fertilization in a year without harvesting was done to favor the vegetative growth and vigor of the trees and to prepare them for the next high yield harvest.

However, no statistical differences were observed, at 5% probability, between the production means (Table 6) and between the vegetative growth rates, measured by the number of nodes (Table 7). Even the control without nitrogen fertilization treatment maintained a mean yield of 73,23 processed coffee sacks per hectare. This may be due to the soil's organic matter content (mean of 3,5%), considered high for this soil type. Through this incorporated organic matter, nitrogen is adequately supplied to the crop. Also, the matter resulting from pruning can contribute to a higher nutrient availability. Sanzonowicz et al. (2000), in a similar work, also did not find production responses to N application above 50 kg of $N.ha^{-1}.year^{-1}$. According to the authors, this

Table 5 – Production of the Catuaí Vermelho IAC 144 crop subjected to pruning cycles between 2003 and 2007. Varginha, Minas Gerais state. 2009.

Treatments	Yield ($sacks.ha^{-1}$)				
	2004	2005	2006	2007	Mean 2004-2007
1- Control without pruning	79,4 a	46,67 a	32,08 b	45,35 b	50,90 a
2- pruning of productive branches + pruning at the end of the branches every 2 years	0,0 b	39,98 a	0,00 c	61,07 a	25,27 b
3- pruning of productive branches + pruning at the end of the branches every 4 years	0,0 b	44,20 a	41,20 a	26,52 c	28,00 b
4- Pruning at the end of the branches	0,0 b	44,35 a	42,85 a	34,98 c	30,57 b
CV%	82,85	15,26	22,65	23,21	16,12

Means followed by the same letter did not differ in the Scott-Knott test (5% probability level).

Table 6 – Yield of a tall Acaiá IAC 474/19 crop subjected to pruning of all productive branches 30 cm from the stem and pruning of the canopy top at 2,0 m, in 2003 and 2005, and fertilized with different nitrogen levels. Varginha, Minas Gerais state. 2009.

Treatments	Yield ($sacks.ha^{-1}$)		Mean Yield
	2005	2007	2005, 2007 ($sacks.ha^{-1}$)
1- Control without nitrogen fertilization	78,15	68,35	73,23
2- 0kg of $N.ha^{-1}$ in high yield harvest; 200kg of $N.ha^{-1}$ in low yield harvest	84,90	77,48	81,20
3- 0kg of $N.ha^{-1}$ in high yield harvest; 400kg of $N.ha^{-1}$ in low yield harvest	81,20	79,60	80,38
4- 200kg of $N.ha^{-1}$ in high yield harvest; 0kg of $N.ha^{-1}$ in low yield harvest	71,53	71,25	71,35
5- 200kg de $N.ha^{-1}$ in high yield harvest; 200kg de $N.ha^{-1}$ in low yield harvest	80,18	72,10	76,13
6- 200kg de $N.ha^{-1}$ in high yield harvest; 400kg de $N.ha^{-1}$ in low yield harvest	85,65	77,50	81,58
7- 400kg de $N.ha^{-1}$ in high yield harvest; 0kg de $N.ha^{-1}$ in low yield harvest	83,20	84,58	83,88
8- 400kg de $N.ha^{-1}$ in high yield harvest; 200kg de $N.ha^{-1}$ in low yield harvest	80,95	70,43	75,68
9- 400kg de $N.ha^{-1}$ in high yield harvest; 400kg de $N.ha^{-1}$ in low yield harvest	81,48	82,53	81,95
CV%	19,86	24,45	18,67

Means in the same column did not differ at 5% probability.

is due to residual fertilization from the previous years and to the pruning at the beginning of the experiment.

Garcia et al. (1986), assessing phytomass and macro and micro nutrient contents in the pruned matter of seven year old Mundo Novo trees 3,5 m tall, found that the amount of nitrogen supplied by this matter varied according to the pruning; simple pruning of the canopy top at 2,0 m supplied 80 kg of $N.ha^{-1}$, pruning at 1,5 m associated to pruning of all productive branches supplied 261 kg of $N.ha^{-1}$, and pruning of the end of the branches supplied 320 kg of $N.ha^{-1}$. The authors also affirm that incorporation of this matter may help reduce or even eliminate, for a period of time, the use of fertilizers.

Although in February 2004, soon after fertilization, leaf N analysis indicated significant differences between the treatments, in July 2004 and November 2006 no significant difference was found (Table 8). Therefore, no effect of different nitrogen fertilizations on leaf N contents was observed.

Table 7 – Vegetative growth (nodes/branches) in 2006 and 2008 in a tall Acaiá IAC 474/19 crop subjected to different nitrogen doses in pruning cycles between 2003 and 2007. Varginha, Minas Gerais state. 2009.

Treatments	Number of nodes/branches
	2006
1- Control without nitrogen fertilization	11,55
2- 0kg de $N.ha^{-1}$ in high yield harvest; 200kg de $N.ha^{-1}$ in low yield harvest	12,28
3- 0kg de $N.ha^{-1}$ in high yield harvest; 400kg de $N.ha^{-1}$ in low yield harvest	11,63
4- 200kg de $N.ha^{-1}$ in high yield harvest; 0kg de $N.ha^{-1}$ in low yield harvest	11,93
5- 200kg de $N.ha^{-1}$ in high yield harvest; 200kg de $N.ha^{-1}$ in low yield harvest	11,95
6- 200kg de $N.ha^{-1}$ in high yield harvest; 400kg de $N.ha^{-1}$ in low yield harvest	11,93
7- 400kg de $N.ha^{-1}$ in high yield harvest; 0kg de $N.ha^{-1}$ in low yield harvest	11,33
8- 400kg de $N.ha^{-1}$ in high yield harvest; 200kg de $N.ha^{-1}$ in low yield harvest	12,23
9- 400kg de $N.ha^{-1}$ in high yield harvest; 400kg de $N.ha^{-1}$ in low yield harvest	11,70
CV%	6,77

Means in the same column did not differ in the Scott-Knott test at 5% probability.

Table 8 – Leaf nitrogen levels in February 2004, July 2004 and September 2006, in a tall Acaiá IAC 474/19 crop subjected to different nitrogen doses in pruning cycles from 2003 to 2007. Varginha, Minas Gerais state. 2009.

Treatments	Leaf Nitrogen (%)		
	02/2004	07/2004	09/2006
1- Control without nitrogen fertilization	2,93 b	3,33 a	2,93 a
2- 0 kg de $N.ha^{-1}$ in high yield harvest; 200 kg de $N.ha^{-1}$ in low yield harvest	2,90 b	3,33 a	2,65 a
3- 0 kg de $N.ha^{-1}$ in high yield harvest; 400 kg de $N.ha^{-1}$ in low yield harvest	2,90 b	3,33 a	2,65 a
4- 200 kg de $N.ha^{-1}$ in high yield harvest; 0 kg de $N.ha^{-1}$ in low yield harvest	3,00 a	3,50 a	2,85 a
5- 200 kg de $N.ha^{-1}$ in high yield harvest; 200 kg de $N.ha^{-1}$ in low yield harvest	3,05 a	3,56 a	2,85 a
6- 200 kg de $N.ha^{-1}$ in high yield harvest; 400 kg de $N.ha^{-1}$ in low yield harvest	2,93 b	3,65 a	2,73 a
7- 400 kg de $N.ha^{-1}$ in high yield harvest; 0 kg de $N.ha^{-1}$ in low yield harvest	3,08 a	3,43 a	2,90 a
8- 400 kg de $N.ha^{-1}$ in high yield harvest; 200 kg de $N.ha^{-1}$ in low yield harvest	2,98 b	3,43 a	2,75 a
9- 400 kg de $N.ha^{-1}$ in high yield harvest; 400 kg de $N.ha^{-1}$ in low yield harvest	3,05 a	3,40 a	3,05 a
CV%	1,25	2,08	3,65

Means in the column followed by the same letter did not differ in the Scott-Knott test at 5% probability.

4 CONCLUSIONS

Pruning of the canopy top at 2,0 m associated with pruning of all productive branches of the Mundo Novo IAC 376/4 crop in two or four year cycles results in a mean yield similar to the control without pruning treatment.

In this experiment, pruning reduced the yield of the Catuaí Vermelho IAC 144 cultivar.

In these experimental conditions, nitrogen fertilization did not enhance productivity or vegetative growth of mature crops planted in deep soils with a high organic matter concentration and return of the pruned matter, subjected to pruning of productive branches and canopy top every two years.

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