PERFORMANCE OF F_4 ARABIC COFFEE PROGENIES BEFORE AND AFTER FRAMEWORK PRUNING

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ABSTRACT: The use of densification in coffee plantations is one of the factors of increased productivity; however, there is the need to select genotypes adapted to this system of planting. The objective of this study was to select progenies from the cross between the Catuaí Amarelo IAC 2077-1-2-12-70 and Mundo Novo IAC 515-20 with good agronomic characteristics before and after framework pruning (cutting off all plagiotropic branches at 20-30 cm from the orthotropic branch). The experiment was conducted at the Experimental Farm of Epamig in the municipality of Tres Pontos, MG , in 1996 , and after evaluating eight harvests the trees underwent pruning. 39 progenies and three cultivars, IAC 99, Rubi MG 1192, Acaiá Cerrado MG 1474, were used as controls, with evaluations for productivity characteristics (before and after pruning), bean yield , percentage of fruits with empty locule, grain types such as flat and oval and grains with a high screen size , length and number of nodes in plagiotrophycal branch and length of the orthotropic bud, after pruning the plants. The genotype 1189-12-52-2 was the most productive before and after framework pruning. The higher yields were presented by genotypes 1189-9-80-3, 1190-2-16-1 and Acaiá Cerrado MG 1474. There were, in all studied coffee trees, low percentages of empty locule and oval fruit, presenting a high percentage of beans with a screen size of 16 and above. The genotypes studied showed satisfactory response to pruning.

Index terms: *Coffea arabica*, productivity, yield, bean quality .

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RESUMO: *A utilização do adensamento em lavouras cafeeiras é um dos fatores de aumento da produtividade, entretanto, há a necessidade de selecionar genótipos mais adaptados a esse sistema de plantio. Objetivou-se, neste trabalho, selecionar progênies oriundas do cruzamento entre as cultivares Catuaí Amarelo IAC 2077-1-2-12-70 e Mundo Novo IAC 515-20 com boas características agronômicas, antes e após a poda tipo esqueletamento. O experimento foi implantado na Fazenda Experimental da Epamig, no município de Três Pontas, MG, em 1996, e após a avaliação de oito colheitas os cafeeiros foram submetidos à poda. Foram utilizadas 39 progênies e três cultivares, Catuaí Vermelho IAC 99, Rubi MG 1192, Acaiá Cerrado MG 1474, utilizadas como testemunhas, sendo avaliadas as características produtividade (antes e após a poda), rendimento de grãos, percentagem de frutos chochos, de grãos tipo chato e moca e de grãos com peneira alta, comprimento e número de nós no ramo plagiotrópico e comprimento do broto ortotrópico, após a poda das plantas. O genótipo 1189-12-52-2 foi o mais produtivo antes e após a poda do tipo esqueletamento. Os rendimentos superiores foram apresentados pelos genótipos 1189-9-80-3, 1190-2-16-1 e Acaiá Cerrado MG 1474. Verificaram-se, em todos os cafeeiros estudados,baixos percentuais de frutos chochos e moca, apresentando alto percentual de grãos peneira 16 e acima. Os genótipos estudados apresentaram resposta satisfatória à poda.*

Termos para indexação: *Coffea arabica*, *produtividade, rendimento, qualidade dos grãos.*

1 INTRODUCTION

Dense planting system is usual both worldwide and in Brazil's coffee culture in order to achieve higher bean yielding. Thus, in such plantings, framework pruning is an imperative practice and one that must be employed avoiding crops' closure, aiming to renew the coffee trees by means of eliminating of unproductive vegetative tissues (THOMAZIELLO et al., 2000) and the development of new branches, propitiating lighting and production increase (CUNHA et al., 1999).

Framework pruning consists in eliminating most of the plagiotropic branches at around 40 cm from the stem, being considered a relatively drastic operation for it reduces a large portion of the aerial part and, consequently, the root system, which will be recovered as the aerial part's budding intensifies

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(QUEIROZ-VOLTAN et al., 2006). Therefore, for the implementation of this technique, it is needed to associate the use of adequate cultivars with the employment of correct handling in order to increase, on short term, the bean productivity in higher levels than in free growth planting.

The objective of the present study was to select F4 progenies resulting from the crossing between the Mundo Novo and Catuai cultivars that present good agronomical features before and after framework pruning.

2 MATERIALS AND METHODS

The experiment took place in January 1996, at the Epamig Experimental Farm (Fazenda Experimental da Epamig), located in the municipality of Três Pontas, southern Minas Gerais state, at an altitude of 900m, 21° 22'01" S latitude and 45° 30'45" W longitude. Average year precipitation is 1670mm and average year temperature is 20,1°C. Soil at the experimental area is classified as Rhodic Ferralsol, since it presents low basic saturation (V < 50%) and Fe_2O_3 levels (by H_2SO_4) of 180g/Kg to <360g/Kg in most part of the first 100 cm of B horizon (SANTOS et al., 2006).

42 genotypes were analyzed, being 39 progenies developed by the Minas Gerais Coffee Tree Genetic Enhancement Program (Programa de Melhoramento Genético do Cafeeiro em Minas Gerais), coordinated by Epamig, and three cultivars, Catuaí Vermelho IAC 99, Rubi MG 1192 and Acaiá Cerrado MG 1474, used as witnesses. The progenies are in the fourth generation selection by self-pollination between the IAC 2077-1-2-12-70 and Mundo Novo IAC 515-20 cultivars. This crossing was performed in the Campinas Agronomical Institute (Instituto Agronômico de Campinas-IAC) and the backcrossings with the parental Mundo Novo were performed by the Agricultural research State System (Sistema Estadual de Pesquisa Agropecuária - EPAMIG/UFLA/UFV).

The experiment was implanted in random bocks, with three repetitions spacing 2,50m between rows x 0,70m between plants, corresponding to 5.714 plants per hectare, being the parcels formed by six plants.

Implantation and conduction followed the technical recommendations for the coffee culture. Fertilizations were performed according to the comission of soil fertility of Minas Gerais (comissão de fertilidade do solo de Minas Gerais, CFSEMG) (GUIMARÃES et al., 1999).

Phytosanitary handling was performed preventively or curatively, by means of crop protection products, monitoring the occurrance of pests and diseases.

Productivity assessments were performed starting from the thirtieth month after planting, measured in beverage litres per parcel, yearly, for eight harvests (1998/1999 to 2005/2006), between the months of May to June each year. Later on, the conversion to 60kg of processed coffee sacs per ha^{-1} was done, by values approximation, which consists in considering an average yield of 480 litres of beverage for each 60kg of processed coffee sac.

Framework pruning was performed after the eighth harvest (2005), when the plants were nine years and six months old. After pruning, at twelve months, the growth was evaluated by means of determining the length of orthotropic and plagiotropic branches and by the quantification of the numbers of nodes in plagiotropic branches. For the first harvest after pruning were evaluated the features productivity, yielding, percentual of epmty locule beans, percentual of oval beans and percentual of beans screen 16 and above.

Length of plagiotropic branch was assessed with the aid of graduated scale, by measuring in two sides of the plant in relation to the planting line, with three measurements in each side of the plant (inferior, medium and superior thirds), in a total of six branches per plant. In these same branches the number of nodes was counted. As for the orthotropic branch's length, it was measured in centimeters from the insertion of the orthotropic bud to the terminal bud, also with the aid of graduated scale.

After pruning, the production was assessed in kilograms of cherry coffee per parcel. Later on, three litres of cherry coffee from each parcel were placed in net type bags and, daily, put under the sun to dry on concrete until they reached humidity between 11% and 12%. Following that, the coffee samples were processed and weighted to estimate yielding, which was obtained dividing the three litres of the sample by the weight of processed coffee. After that, the conversion to 60kg of processed coffee per hectare was done, considering the yielding obtained from each parcel.

Percentage of empty locule beans was estimated by the methodology proposed by Antunes Filho and Carvalho (1957), in which 100 cherries were put in water, being considered empty locule those that stayed on the surface.

Using 500g samples, the dry and processed coffees were classified by intercalary screens. For statistic analysis was considered the percentage of flat beans resulting from the sum of the screens (16 sieve and above). Percentage of oval beans was obtained by the sum of all screens of oval beans 10 and above (BRASIL, 2003).

After the described procedures, experimental data were compiled and subjected to variation analysis. 'Sisvar' (FERREIRA, 2000) computer system was used. Detecting the differences between the treatments, the averages were grouped by the Scott-Knott test.

3 RESULTS AND DISCUSSION

There was a significative effect for all the features assessed by the F test, at 1% and 5% chance, except for the number of nodes in the plagiotropic branches, indicating the progenies showed different behavior in the essay conditions. The experimental variation coefficient varied from 6,13% to 19,5%, showing there is good precision at the features assessment.

Vegetative parameters after pruning

It was noticed that the Acaiá Cerrado MG 1474 cultivar showed larger length of the orthotropic and plagiotropic branches as related to the others (Chart 1).

According to Medina Filho, Bordignon and Carvalho (2008), low presence is a feature controlled by four dominant and independent genes, which shorten the internodes of the orthotropic and plagiotropic branches, making the plants lower and bulkier, without harming productivity, by the fact that the beans come from the leaves' axils that grow on the nodes and not in the internodes that are shortened by such genes. It must be taken into consideration the fact that the Acaiá Cerrado MG 1474 cultivar has long internode length (FAZUOLI et al., 2008), in spite of the Rubi MG 1192 and Catuaí Vermelho IAC 99 cultivars (CARVALHO et al., 2008).

It is important to highlight that the studied progenies come from the crossing between Catuaí and Mundo Novo cultivars, as those show short and long internodes, respectively. The low presence of the plants is a desireable feature and controlled during the selection process, therefore, notice that only the progeny 1189-12-52-1 showed intermediate height, being inferior to Acaiá Cerrado MG 1474 and superior to the others.

It was verified, in general, a low phenotypical variability between the evaluated progenies under vegetative parameters, corroborating Aguiar (1999), which characterized in four environments, eleven lineages of the commercial *Coffea arabica* L. cultivars selected by the IAC under morphologic and agronomic parameters, and low genotypical and phenotypical variabilities by means of the vegetative and reproductive features assessed.

CHART 1 - Average values of orthotropic (CBO), plagiotropic (CRP) branches lenghts and number of nodes in plagiotropic branches (N) of the genotypes after framework pruning.

Genotypes	CBO (cm)	CRP (cm)	N (unid.)
1189-12-6-1	51,37 c	36,56 c	10,49 a
1189-12-27-1	52,83 c	35,89 c	10,56 a
1189-12-52-1	73,59 b	44,21 b	10,01 a
1189-12-52-2	54,02 c	41,18 b	10,62 a
1189-12-72-2	51,53 c	35,97 c	10,06 a
1189-12-94-1	49,06 c	38,73 c	10,23 a
1189-12-117-3	47,11 c	35,02 c	10,46 a
1189-9-5-2	47,72 c	36,10 c	10,10 a
1189-9-5-3	41,02 c	35,37 c	10,06 a
1189-9-80-1	50,32 c	42,78 b	11,31 a
1189-9-80-2	45,48 c	36,71 c	10,85 a
1189-9-80-3	48,76 c	36,99 c	10,37 a
1189-12-106-1	45,58 c	34,41 c	10,07 a
1189-12-106-2	52,15 c	34,27 c	9,93 a

1189-12-106-4	50,96 c	37,22 c	10,59 a
1189-12-126-2	48,20 c	34,01 c	10,02 a
1189-12-126-4	50,27 c	34,78 c	9,94 a
1190-2-7-1	45,54 c	34,16 c	10,45 a
1190-2-7-3	44,14 c	35,16 c	10,27 a
1190-2-7-4	44,21 c	35,26 c	10,89 a
1190-2-16-1	57,26 c	41,87 b	9,85 a
1190-2-16-2	48,12 c	37,18 c	10,57 a
1190-2-16-3	42,91 c	37,92 c	11,02 a
1190-2-26-3	46,58 c	36,61 c	10,73 a
1190-2-128-2	51,88 c	36,10 c	10,89 a
1190-2-128-4	47,20 c	34,36 c	10,37 a
1190-11-8-2	42,95 c	40,02 c	10,28 a
1190-11-8-4	56,51 c	36,39 c	10,72 a
1190-11-17-1	48,02 c	35,46 c	10,55 a
1190-11-17-4	45,22 c	35,45 c	9,94 a
1190-11-34-1	47,82 c	33,96 c	10,49 a
1190-11-34-3	47,57 c	32,01 c	10,56 a
1190-11-70-1	37,05 c	35,83 c	10,31 a
1190-11-70-2	48,60 c	38,64 c	10,76 a
1190-11-70-4	52,71 c	38,43 c	11,07 a
1189-12-126-3	50,70 c	36,48 c	10,85 a
1190-11-108-3	48,97 c	35,76 c	10,51 a
1190-11-119-1	40,55 c	32,26 c	10,11 a
1190-11-128-1	47,90 c	34,38 c	10,00 a
Catuaí Vermelho IAC 99	47,65 c	36,67 c	10,18 a
Rubi MG 1192	50,08 c	36,41 c	10,37 a
Acaiá Cerrado MG 1474	88,20 a	55,14 a	11,75 a
Average	49,72	36,95	10,48
CV (%)	11,45	7,72	6,13

Averages followed by the same letter belong to the same group, by the Scott-Knott test, at 5% probability.

Agronomical features

There was a statistically significative difference for the prudctivity features of eight harvests (1997/1998 to 2004/2005) before pruning, productivity after pruning (2007/2008 harvest), yielding, percentage of empty locule beans, percentage of flat beans with 16 size screen and above and of oval beans 10 size screen and above, as presented in Chart 2.

CHART 2 - Average productivity of processed coffee (Prod.[1]), in 60Kg.ha^{-1} sacs of eight harvests evaluated before pruning (harvests 1997/1998 to 2004/2005). Productivity (Prod.[2]), yielding (yield.) (litres of beverage per 60 Kg processed coffee sac per hectare), percentage of empty locule beans (Empty), 16 and above screen beans (Screen) and oval 10 and above screen (oval), assessed after pruning (harvest 2007/2008).

Progeny	Prod.[1]	Prod.[2]	yield.	Empty	Screen	oval
1189-12-6-1	36,29 c	64,63 c	456,59 c	5,40 b	75,99 b	10,78 c
1189-12-27-1	39,19 b	84,00 b	417,40 b	8,17 d	74,27 b	8,83 b
1189-12-52-1	19,81 e	45,97 c	445,73 c	7,58 d	77,00 b	8,27 a
1189-12-52-2	47,90 a	100,43 a	464,93 c	5,71 c	80,47 a	7,98 a
1189-12-72-2	39,81 b	69,10 c	462,71 c	6,17 c	80,35 a	7,79 a
1189-12-94-1	42,00 b	67,53 c	452,21 c	4,14 a	82,45 a	6,60 a
1189-12-117-3	28,67 d	51,77 c	568,19 e	6,67 c	81,73 a	7,90 a
1189-9-5-2	44,57 a	83,33 b	439,81 c	5,99 c	78,45 a	7,60 a
1189-9-5-3	29,44 d	61,60 c	480,06 c	6,97 c	74,41 b	9,57 b
1189-9-80-1	48,75 a	68,50 c	419,40 b	4,79 b	80,50 a	7,18 a
1189-9-80-2	33,06 c	56,80 c	462,30 c	8,13 d	82,93 a	7,17 a
1189-9-80-3	51,36 a	73,70 b	376,99 a	6,63 c	82,27 a	7,30 a
1189-12-106-1	42,62 b	69,90 c	460,01 c	5,15 b	76,47 b	8,41 a
1189-12-106-2	39,36 b	73,93 b	413,00 b	4,07 a	74,27 b	9,28 b
1189-12-106-4	38,92 b	76,50 b	438,47 c	3,79 a	81,25 a	7,22 a
1189-12-126-2	32,67 c	81,83 b	418,80 b	9,84 d	76,46 b	7,42 a
1189-12-126-4	34,50 c	73,13 b	432,13 c	6,69 c	79,36 a	9,07 b
1190-2-7-1	42,21 b	61,63 c	428,80 b	5,69 c	80,21 a	7,74 a
1190-2-7-3	31,92 c	68,93 c	484,99 c	4,87 b	77,80 b	7,45 a
1190-2-7-4	33,61 c	73,17 b	479,35 c	6,17 c	74,58 b	9,08 b
1190-2-16-1	37,77 c	65,43 c	380,95 a	5,89 c	80,61 a	8,34 a
1190-2-16-2	44,72 a	85,07 b	443,18 c	3,91 a	75,98 b	7,01 a
1190-2-16-3	33,38 c	68,77 c	443,98 c	5,64 c	76,06 b	8,58 a
1190-2-26-3	36,66 c	67,30 c	484,40 c	4,02 a	75,58 b	7,75 a
1190-2-128-2	34,63 c	53,63 c	583,12 e	5,84 c	78,67 a	8,16 a
1190-2-128-4	44,52 a	67,30 c	460,93 c	5,75 c	80,14 a	8,42 a
1190-11-8-2	35,32 c	66,77 c	514,30 d	5,16 b	76,86 b	6,83 a
1190-11-8-4	45,88 a	81,67 b	448,10 c	3,38 a	78,25 a	7,26 a
1190-11-17-1	39,53 b	62,30 c	472,77 c	5,30 b	76,27 b	9,37 b
1190-11-17-4	38,76 b	75,50 b	448,41 c	5,87 c	73,26 b	11,24 a
1190-11-34-1	35,54 c	63,27 c	519,50 d	7,73 d	72,94 b	9,03 b
1190-11-34-3	29,43 d	55,07 c	437,53 c	3,25 a	78,11 a	8,29 a
1190-11-70-1	39,72 b	82,60 b	452,22 c	4,24 a	75,67 b	7,65 a
1190-11-70-2	41,32 b	99,40 a	456,19 c	5,30 b	72,21 b	7,90 a
1190-11-70-4	41,83 b	68,77 c	459,49 c	5,51 c	73,18 b	8,30 a
1189-12-126-3	37,62 c	72,20 b	437,81 c	7,71 d	74,08 b	10,20 a
1190-11-108-3	37,04 c	70,60 c	496,60 d	6,90 c	74,66 b	7,85 a

1190-11-119-1	39,21 b	54,00 c	450,60 c	4,01 a	76,88 b	7,89 a
1190-11-128-1	37,67 c	80,37 b	468,23 c	2,98 a	76,06 b	6,41 a
Catuai Verm.	34,35 c	72,90 b	455,81 c	4,96 b	78,61 a	7,66 a
Rubi	47,00 a	81,43 b	487,98 c	3,24 a	81,31 a	6,33 a
Acaiá Cerrado	31,83 c	79,17 b	380,12 a	2,43 a	84,30 a	7,24 a
Average	38,08 A	70,95	455,39	5,52	77,64	8,10
CV (%)	13,19	14,52	6,31	19,5	4,92	13,15

Averages followed by the same letter belong to the same group, by the Scott-Knott test, at 5% probability.

Productivity before and after pruning

When are considered the productivities before pruning, the genotypes 1189-12-52-2, 1189-9-5-2, 1189-9-80-1, 1189-9-80-3, 1190-2-16-2, 1190-2-128-4, 1190-11-8-4 and the Rubi MG 1192 cultivar stood out from the others, with productivity varying from 44,72 to 51,36 sc ha^{-1} average of the eight harvest overcoming the Catuaí Vermelho IAC-99 and Acaiá Cerrado MG-1474 cultivars, whose productivities were of 34,35 and 31,83 $sc.ha^{-1}$, respectively (Chart 2). Similar result was found by Carvalho et al. (2006b), evaluating progenies from the same crossing in São Sebastião do Paraíso (MG), in the average of six harvests. In that work, the authors identified a group of progenies with higher productivity in relation to the Catuaí Vermelho IAC 99 and Acaiá Cerrado MG 1474 cultivars, used as witnesses.

When the data referring to the first production after framework pruning are assessed, the productivity is observed as varying from 45,97 100,43 sacs of processed coffee ha^{-1}. A harvest is considered efficient when it is capable of forming, year after year, an extended and well lightened canopy, with high photosynthetic rate, capable of producing a high number of beans and of mobilizing large sums of carbohydrates for bean filling (RENA et al., 1994). Thus, it is possible to say that the studied genotypes showed a positive response to the pruning intervention.

After pruning, it was observed that the higher productivities (Chart 2) were obtained from the progenies 1189-12-52-2 (which also stood out before pruning) and 1190-11-70-2, which showed average productivity of 100,43 and 99,40 sc ha^{-1}, overcoming the Rubi MG 1192, Acaiá Cerrado MG 1474 and Catuaí Vermelho IAC 99 cultivars, in 22,10%, 25,6% and 36,4%, respectively. These results concur, in part, with the ones obtained by Carvalho et al. (2006a, 2006b) who, working with the same progenies in the cities of Campos Altos, Capelinha, Três Pontas and São Sebastião do Paraíso also observed higher productivity and adaptability of the progeny 1190-11-70-2. These authors observed that the progenies 1190-11-70-2, 1190-11-119-1, 1190-11-70-1 and 1190-11-8-2 showed the higher average productivities.

The satisfactory performance related to the bean productivity of these progenies in selection is justified by the productive potential of the parentals, as reports found in literature. According to Fazuoli et al. (2005), the progenies of the cultivar Mundo Novo have an excelent productive capacity, good lifespan and excelent rusticity. These same authors, evaluating Mundo Novo, Bourbon Amarelo and Bourbon Vermelho cultivars in the municipality of (SP), noticed that, between the 30 most productive progenies, four belonged to the S_2 generation of Mundo Novo and that the rest belonged to Mundo Novo S_1, indicting the efficiency of the selection. No progenies of Bourbon Amarelo or Bourbon Vermelho showed themselves as productive as Mundo Novo. In the same way, Martins et al. (1992) observed similar productions from progenies of Catuaí Amarelo, Catuaí Vermelho and the standard Mundo Novo. Queiroz, Almeida and Matielo (2002), in the evaluation of diverse coffee trees with resistance to coffee leaf rust and lineages of Catuaí in Caratinga-MG, verified that the cultivars Catuaí Amarelo IAC 62, IAC 32 and Catuaí Vermelho IAC 99, produced more in the three harvests average.

Yield

For the yield feature there was a large variation between the studied genotypes, which were grouped in five different groups. The genotypes 1189-9-80-3, 1190-2-16-1 and the cultivar Acaiá Cerrado MG 1474 showed superior yieldings, varying from 376,9 to 380,9 litres of beverage for each 60Kg processed coffee sac.

A second group was formed by five genotypes, 1189-12-27-1, 1189-9-80-1, 1189-12-106-2, 1189-12-126-2, 1190-2-7-1, varying between 413,0 and 428,8 litres.

The yielding of processed beans (obtained through a certain volume of cherry coffee) is influenced, among other factors, by the occurrance of empty locule beans, oval or misshaped beans (CARVALHO; ANTUNES FILHO, 1955; GASPARI-PEZZOPANE; MEDINA FILHO; BORDIGNON, 2004; MÔNACO, 1960). These beans features are influenced by weather and genetic factors, being the last, target of study of coffee tree genetic enhancement programs.

In the present work, there was an amplitude variation of 54% of yielding among the studied genotypes (if considered the higher and lower yields assessed). In coffee experiments, several works have shown the importance of correcting the gross production (coffee beverage) to the processed coffee values, which is the real production (DIAS et al., 2005; MARTINS et al., 1992). This factor must be taken into consideration as a plus in coffee tree selection, however, the environmental influences that affect it.

Percentage of empty locule beans

Analysing the percentage of empty locule beans (Chart 2), a large phenotypical variability of the progenies is noticed for this feature, with the formation of four distinct groups. It is verified that all the genotypes show higher well grained beans percentage in relation to empty locules, with an amplitude varying from 90,16% to 97,57%. According to Carvalho et al. (2006a), above 90% of well grained beans is a percentage considered satisfactory by the improvers, during evaluation and coffee tree selection in enhancement programs, since most of the commercial cultivars present such percentage.

It is worth noticing that the genotypes 1190-11-70-1, 1189-12-106-4, 1190-11-119-1, 1190-2-16-2, 1190-11-8-4, 1190-11-34-3, Rubi MG 1192, 1190-11-128-1 and Acaiá Cerrado MG-1474 showed a high percentage of well grained beans (varying from 95,7 to 97,6) attached to the high productivity, highlighting Acaiá Cerrado MG 1474 and the genotype 1189-12-106-2, which also showed satisfactory yielding. Such features highlight even more the potential of such genotypes, given that, the higher the percentage of well grained beans, higher is the yielding of cherry coffee in relation to the processed and, consequently, higher is the progeny's productive potential.

However, these results are contradictory to the ones found by Carvalho (2006b) who, assessing progenies of the fourth generation from the crossing between Catuaí x Mundo Novo in several locations, observed after six harvests that the progenies 1190-11-8-4, 1190-11-70-1 and 'Acaiá Cerrado MG-1474' showed, average, a percentage below 90% of well grained beans. This difference of results can be accredited to weather and cultivation factors. According to Severino (2000), the occurrance of empty locule beans could also be influenced by genetic and morphologic factors such as location of bean in plant, photoassimilates breaking and by factors such as pests and diseases and thermal and nutricional stresses.

Percentage of high screen

As for size 16 screen and above, the formation of two distinct groups was observed. In the superior group are inserted 16 genotypes and the three studied witnesses (Chart 2), varying from 78,1 to 84,3%. These results differ from those found by Dias et al. (2005), in which the Acaiá Cerrado MG 1474, Catuaí Vermelho IAC 99 and Rubi MG 1192 cultivars stayed in an intermediate group, with averages between 71,5% and 63,5% of beans retained in 16 and above screen. However, the size of beans also suffers interference from abiotic factors. According to Alves (2008), the coffee beans expand until maximum size at around December, keeping in their interior an aqueous consistency. Hidric stress during that stage may impair their growth and filling, resulting in percentage of low screen beans.

In the inferior group are inserted 23 genotypes, with high screen percentage varying between 72,21% and 77,80%. Thus, it is important to highlight that all of the genotypes showed a high percentage of high screen beans, being that a feature searched by enhancers and wished by coffee producers and consumers. High value in a medium screen can be an expression not only of good genetic features, but also an indication that the coffee plantation was in good nutrition and sanity conditions during the beans' development (ALVARENGA, 1991).

Screen classification is indicated since it is a feature related to the quality standards of the product, so that it serves as a measurement in the selection of genotypes of a new variety (FONSECA, 1999). So, as proposed by this work, the progenies that showed a better screen rating should be considered for future coffee tree genetic enhancement works.

Oval type beans percentage

When the percentage of oval beans is considered, it is noticeable that three groups were formed. Most of the genotypes showed low percentage of beans of this type. The genotypes 1190-11-17-4, 1189-12-6-1 and 1189-12-126-3 showed respectively 11,24%, 10,78% and 10,20% oval type beans screen 10 and above. The intermediate group was formed by seven progenies, with percentage variation between 8,83 and 9,57 and the superior group, as in the high screen percentage, was formed by most of the genotypes and the studied witnessess, with oval beans percentage varying from 6,60 to 8,58%.

There is not a demand for maximum oval beans percentage as a criteria to assess the beans' quality. Guimarães, Mendes and Souza (2002) quote that, for the production of certified beans, the standardization criteria indicates a maximum tolerance of 12% of oval beans. So, the results observed in the present study do not indicate impairment for any of the studied progenies.

4 CONCLUSIONS

The genotypes studied showed satisfactory response to pruning intervention.

1189-12-52-2 genotype was the most productive before and after framework pruning. The superior yielding were shown by the genotypes 1189-9-80-3, 1190-2-16-1 and 'Acaiá Cerrado MG 1474'. Low empty locule and oval percentages were observed in all of the studied coffee trees, showing high screen values.

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