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Financial Feasibility Analysis for Rose Cultivation by Integrated Production System

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Abstract

The current work aims to analyze the financial and economic feasibility of 'Corolla' roses' cultivation by integrated production system. Roses' integrated production system is a production alternative in terms of sustainability conceptions that look forward to: reduce the amount of pesticides, develop safe products and services, improve products' quality adding value to them, improve productivity and reduce costs. It was used the financial and economic classical analysis approach in order to calculate net present liquid (NPV) and internal rates of return (IRR) indicators in 'Corolla" roses' cultivation by integrated production system with 100%, 75%, 50% and 25% chemical and organic manures. And, still, costs, expenses and discount cash flow were measured. Outcomes pointed out that 25% consecutive reductions in manures chemical and organic without green manure, did not lead to significant variations in financial feasibility indicators from roses' cultivations by integrated production system, among the treatments. Therefore, it was concluded that producers will be able to make an option for integrated production systems in roses' cultivation with up to 75% reduction on chemical and organic manures that were proved to be financially feasible, besides being environmentally and socially fair.

Keywords: *Financial Feasibility Analysis. Integrated Production System. Roses.*

1 Introduction

New floristry investors have been evaluating up to date production technologies and storage and distribution. They aim to fulfill the new demands from the international and national markets. Such demands regard the quality of products and/or services, food safety and traceability as well as prices reduction, competitiveness and respect to social, environmental and economic aspects.

Regarding rosebushes – the main object of the current study -, there is a question that still needs to the discussed: controlling the use of pesticides in production by applying rationalization techniques to balance the use of water, adjust plants' nutrition, control erosion and set crop rotations as well control propagation material's quality. Besides the aforementioned matter, harvest and post-harvest stages throughout the production phase must also be observed in order to achieve an efficient control and the correct use of storage technologies and logistics systems such as the transportation forms.

Throughout harvest, packaging and flower bouquets' preparation process as well as during the time bouquets are stored in closed environs, the residues from pesticides applied to the rosebushes can penetrate the human body by means of direct contact with the skin or by inhalation. Besides, rose petals are used to prepare herbal medicines, food, to decoration and therapeutic baths. It turns such residues on the petals into an even more critic matter. Part of the roses' production in Brazil has its origins in family agriculture; therefore, the widespread use of pesticides puts the whole family in risk (ALMEIDA, 2012).

The biggest challenges faced by rose cultivations due to plague and disease control. It detracts the final product – the rose buds -, once injuries caused by microorganisms and insects are unacceptable. That is why many producers apply preventive spraying with high rates of actives that lead to plants' toxicity, besides causing damages to the environment and to the health of field workers who are involved with the cultivation process (ALMEIDA, 2012).

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Fertilizers play a significant role in production costs. When used in excess or on the wrong way – just as in the case of roses' cultivation -, they can pollute the environment (mostly water and soil), the product itself as well as harm workers health. It makes careful manure handling a substantial matter to fulfill cultivation needs to minimize nutrient losses (leaching and erosion) and optimize productivity. Besides, production system's sustainability depends on the quality of the soil. It is directly related to the maintenance/improvement of chemical, physical and biological attributes of its production capacity throughout time.

Floristry economic activities have roses as their main product in Brazil. Roses' production is centralized in the states of: São Paulo, Minas Gerais and, recently, the country's Northeast region, mainly the state of Ceará. Ceará is strongly investing on it and has been reaching excellent productivity, meeting all the exportation quality standards (ALMEIDA et al., 2012).

Roses' cultivation for commercial matters is a quite promising business. The demand for rose seedlings increased in the last years. Many nurserymen have been investing on such sector, expecting good revenues. However, rosebush is a very demanding species and the success of its cultivation depends on techniques that – if properly applied – will enable the production of high quality floral stems in quantities able to justify the investments (ALMEIDA et al., 2012).

Current rose production methods used in Brazil usually lead producers to spray big amounts of pesticides on their rose crops. It can cause serious consequences to the health of field workers and consumers. The uncontrolled use of pesticides throughout time also enables the accumulation of residues from harmful chemical compound in the water, soil and air.

As mentioned by Alencar (2008), when pesticides are inadequately handled and applied in uncontrolled amounts, they increase socio-environmental vulnerability, contaminate workers and the environment as well as increase crop's susceptibility to pathogenic agents resistant to actives.

According to Almeida et al. (2009), the expansion of floristry in both the national and international contexts as well as the product's offer indicate that producers need to become experts in order to stay on the market. They must look for strategies to help them to reducing production costs and improve the quality of flowers and decorative plants.

Thus, in order to keep the sector growing, it is necessary to boost production by inserting technologies to reduce the use of pesticides and the amount of water and electric power. It is also mandatory reducing soil and water contamination as well as the contamination of the product itself. Another relevant demand regards the development of specialized man power to perform production, harvest and post-harvest activities.

Some research has been developed in order to support flower and decorative plants' production. They aim to present integrated production systems that help offering high quality roses by applying the rational use of inputs used in an environmentally sustainable production. A good example of it fruits' production system: "Programa de Produção Integrada de Fruitas (PIF) – Integrated Fruit Production Program", that has been used in Brazil since 1996.

Roses' integrated production system an alternative in terms of sustainable conceptions. Such conceptions aim to reduce the use of pesticides improving the safety of products and/or services as well as improving quality although also adding more value and better productivity enabling cost reductions. Therefore, the integrated system advocates for socially fair and economically feasible environmental production.

The current study aims to assess the financial feasibility of applying the integrated production system to the cultivation of 'Carolla' roses. The goal was to identify financial indicators by means of traditional methods such as: net present value (NPV) and internal rate of return (IRR), based on experimental data from 'Carolla' rose cultivated under integrated production system regulations; as well as assess costs, expenses and discount cash flows.

2 Theoretical References

2.1 Contextualizing the Brazilian floristry

Floristry in Brazil deserves to be highlighted once it is getting high technological investments. Its production is centered in the state of São Paulo and its retailers are taking relevant actions to improve the volume of sales.

According to Landgraf and Paiva (2008) floristry is featured by the cultivation of decorative plants, cut plants (flowers and foliage), potted plants – flowering or not -, as well as by the production of seeds, bulbs, palm trees, bushes, tree seedling and other species that might be cultivated in gardens. Due to such large variety of products, the sector demands advanced technologies, technical knowledge, efficient production systems, good distribution and sales practices.

The production conditions in Brazil – due to its soil and climate diversity –, allows cultivating a large number of species that prove to hold good quality and beauty. National products such as tropical flowers, bromeliads, orchids and others have been stimulating the creation of new markets. They are quite competitive in the global market. Landgraf and Paiva (2008) also mentioned that most of the Brazilian production is still being sold to the internal market.

Junqueira and Peetz (2008) point out the few tendencies that are leading the sector's development: a) production decentralization - consolidating and fortifying regional poles; b) large consumption diversification - introducing species and cultivars adapted to regional tastes and cultures; c) reduction of centralized roles - nowadays fulfilled by the São Paulo's production pole; d) strong Transportation optimization -reducing logistics costs, displacing goods; e) sales increase - in supermarkets and on line.

According to Oliveira and Brainer (2007), besides the consumption potential of the internal market, the sector's main goal is the external market. Therefore, producers must focus on requirements from consumers who besides quality and price, demand: regular shipments, respect to working polices and the environment.

The consumption of flowers and decorative plants has been globally increasing in the last few years. The production and consumption of flowers and decorative plants in Brazil is also growing, following the expansion tendencies of the world market.

Oliveira and Brainer (2007) emphasize the importance of cut flowers because they represent sales' main product. So, it is possible highlighting that: roses, carnations and chrysanthemums are the main products and potted flowers and foliage come after them.

Commercially producing flowers for exportation demands meticulous cares in order to reach good final quality standards, because of the strong requirements set by the international market. Producers must always focus on eventual matters, mainly on the incidence of plagues and diseases that can compromise and increase production costs. Due to such aspects, it is essential to have protected cultivations, favored by good climate conditions and healthy plants (ALMEIDA et al., 2012).

2.2 The Integrated Production System

The last few years had showed growing world demands for safe production processes that cause minimum impact to the environment. They also require diminishing the use of pesticides in order to protect field workers and consumers. Besides adopting competitiveness, sustainability and traceability principles, there is still a growing need for thinking about innovative and efficient actions to replace production conventional practices (TONELLI et al., 2012; TONELLI et al.; 2013).

Based on such context, there are national and international rules taking under consideration aspects related to product's safety and quality as well as to its production process. Such rules resulted from governmental efforts and from the efforts of agents in the public and private sectors that are linked to food sales. They were defined in order to ensure food safety and to fulfill standard demands from new consumers.

Countries in the European Union relay on the International Organization for Biological and Integrated Control of Noxious Animals and Plants – IOBC/WPRS. In the 1970´s they have developed the concept of Integrated Production (IP), aiming to fulfill consumers, distributers and supermarket requirements. They look for health food without pesticide's residues, and that are environmentally and socially fair. It was motivated by actions taken by consumers' defense bureaus (ANDRIGUETO et al., 2009).

The definition for integrated production as well as its aims was created on March 6th, 1992, in Wadenswill – Switzerland, by means of a cooperation process between IOBC and WPRS:

> *Integrated production is a farming system that produces high quality food and other products by using natural resources and regulating mechanisms to replace polluting inputs and to secure sustainable farming. Emphasis is placed on a holistic systems approach involving the entire farm as a basic unit, on the central role of agro-ecosystems, on balanced nutrient cycles and on the welfare of all species in animal husbandry. The preservation and improvement of soil fertility and of a diversified environment are essential components. Biological, technical and chemical methods are balanced carefully taking into account the protection of the environment, profitability and social requirements (IOBC/WPRS, 2010).*

Integrated Production highlights Good Agricultural Practices (GAP) preserving and increasing soil fertility and environmental diversity. Biological, technical and chemical controls are carefully balanced, taking environmental protection under consideration, looking forward to meet economic feasibility, respecting social matters (ZAMBOLIM et al., 2003).

Such new agricultural tendency of looking for certifications is given by strategies set in order to meet worldwide requirements that aim to reinforce environmental preservation and to ensure food safety. It might result from the fact that in the XX century's last decades there was an accelerated devastation of forests, bad soil conservation, water resource degradation, growing environmental pollution as well as damaging effects to the environment, humans and food because of the excessive use of pesticides (CHABOUSSOU, 1987; KOEPF et al., 1986; PASCHOAL, 1994; PRIMAVESI, 1978).

According to Andrigueto et al. (2009); Portocarrero and Kososki (2009) since its conception, Integrated Production aims to meet systemic views initially turned towards plagues integrated handling, going upwards to the integration of processes and finally sighting all the production chain. Thus, its implementation must be understood in a holistic way and lay over four sustainability pillars: (I) the organization of the productive base, (II) sustainability system, (III) process monitoring and (IV) data base/information; components that both integrate and consolidate other processes (Figure 1).

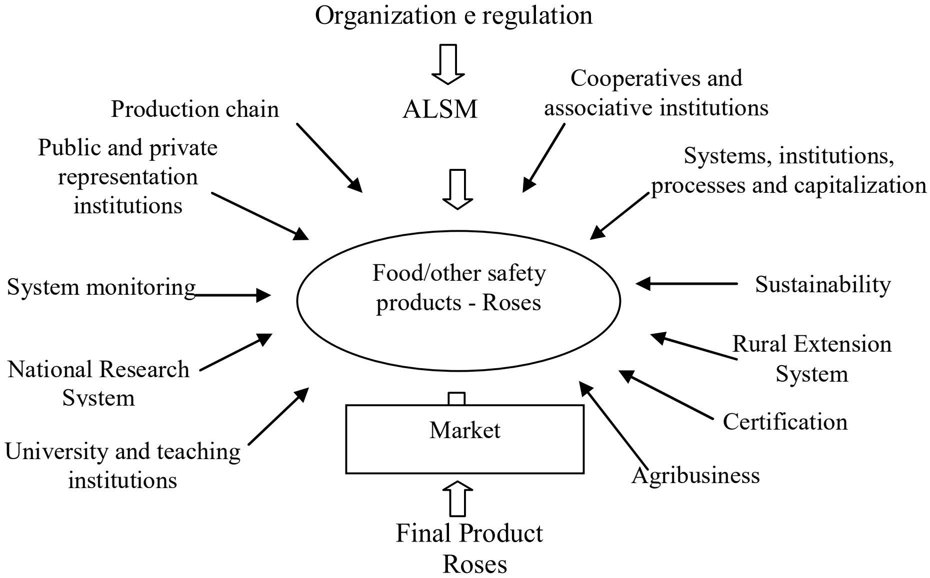

Figure 1 Organization and regulation of integrated production systems applied to roses' cultivation
Souce: Adapted from Andrigueto et al. (2009); Portocarrero and Kososki (2009).

According to Portocarrero and kososki (2009), in order to make the Safe Food and or Other Products Policy real, it is worth firstly setting the main aims of such policy: the organization of plans, programs, systems, projects and institutional instruments guided by similar public policies that head towards the obtainment of safe food and other products that comprise sanitation, technological, environmental and social requirements; homogenizing procedures in face of international quality standards and supporting the Brazilian agribusiness production chain (Figure 2).

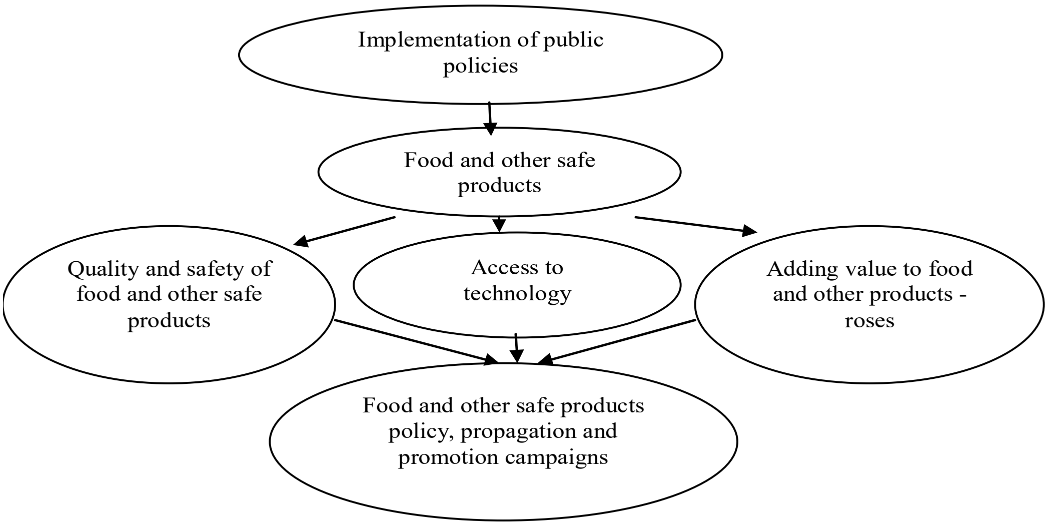

Figure 2 Process to implement public policies to food and other safe products such as roses
Source: Adapted from Portocarrero and Kososki (2009).

Thus, implementing policies based on management, quality and safety production models that head towards adding values to food and other commercialized products, leading to sustainability, procedure monitoring, good agribusiness practices and traceability - in all production stages, since inputs' acquisition up to the product's offering -; is one of the main public targets in regards to sustainable agriculture (TONELLI et al., 2012).

The legal milestone to Livestock Integrated Production in Brazil (IP Brazil) was set by Normative Instruction #27. It is validated by the Specific Normative Techniques – SNT in order to have the official certification stamp on both animal and vegetal products. The system started in 2011 with the Fruits Integrated Production. It was coordinated by the Agriculture, Livestock and Supplying Ministry (ALSM) along with public and private partnerships (Normative Instruction # 27, ALSM, 2010).

The Normative Instruction number 27 establishes directions for the programs and projects that foster and develop the Integrated Production System – PI Brazil aiming to support the productive chains to cope with the market requirements and aiming to elevate the quality and competiveness standards of the farming products to the level of excellence. In this sense, it fosters the sustainable farming, the diffusion and transference of technologies, technological innovations, good farming practices and animal welfare, with basic elements of transference of the convention farming into sustainable, certifiable and traceable (TONELLI, et al. 2012).

Two projects about Flowers and Decorative Plants' Integrated Production were launched in 2008 by the Agriculture, Livestock and Supplying Ministry (ALSM) along with the "Empresa Brasileira de Pesquisa Agropecuária (Embrapa) – Brazilian Livestock Research Company". The first one concerns Roses' Integrated Production in the state of São Paulo, mainly in Holambra County's region – Local Production Arrangement (LPA) for flowers, in Brazil. It holds the possibility of expanding flowers and decorative Plants' production. The second project was developed in the state of Ceará. It involves tropical flowers and aims to supply the national market and to export.

Due to demands from national and international consumer markets, information about the products' origin and quality, combined with the importance of exportations to the floristry sector, it is worth implementing the Roses' Integrated Production project in order to help improving the quality of flowers' production in the Country and optimizing the properties' organization by adopting adequate water and soil use practices; plants, plagues, diseases and weeds integrated handling; pre and post harvest treatments and the rational use of pesticides (MARTINS et al., 2009).

3. Methodology

3.1 Object of study

The current study's object of research comprises the financial analysis of roses' cultivation by integrated production system. The Fruits Integrated Production System (FIPS) was adapted to be used by the current study, as described by Fráguas et al., (2001), once there was no information in the literature about integrated production in the floristry sector. All the used procedures were recorded in a field notebook in order to allow monitoring. Such recordings of all the activities in the field notebook held data bases that were used in the present research.

The experiment used rose seedlings grafted from the variety 'Carolla'. It presents dark-red shades, velvety petals, good market acceptance and is quite productive in the region of Barbacena County, in the state of Minas Gerais (MG). The rose seedlings were produced by grafting methods.

The experiment was performed in a 19.2m x 24.0m greenhouse. It was built out of metallic arches, diffuser plastic on the ceiling and open sides. The roses were cultivated inside such greenhouses, in 15cm tall gardens, in simple straight lines 1,20m away from each other with a 0.20m gap between each plant. The randomized block technique was the experimental design in a space split spot arrangement with eight treatments and four repetitions.

The treatments, as per Chart 1, were comprised by 4 chemical manure percentages (25, 50, 75 and 100%) - as recommended in Minas Gerais (Comissão, 1999) - versus the presence and the absence of a consortium with green manure (*Calopogonium mucunoides*). The plants that underwent 100% chemical manure - recommendation for rose cultivation in the state of Minas Gerais - had received respectively, 80Kg of N, 300Kg of P_2O_5 and 240Kg of K_2O by hectare during cultivation and 60Kg of N, 35 Kg of P_2O_5 and 60Kg of K_2O were monthly applied to the cultivation (Comissão, 1999). Treatments that got 100% chemical manure were incremented with 2 types of bio-fertilizers also monthly applied to the crop. The first one was Bokashi (16 g/plant, applied via soil) and the second, Supermagro (15% applied via foliar). Supermagro was produced according to the methodology used by Venzon et al. (2006).

The 3m² shares were built on three lines with six plants in each, totalizing 18 plants per share. Six (6) plants were used as useful shares. Assessments had started 195 days after cultivation and were done three times a week, in a period between 60/11[th]/2010 and 06/10[th]/2011. The stalks were picked according to commercial standards and were evaluated afterwards.

Chart 1 Treatments applied to roses' cultivation by Integrated Production System in an experiment performed in a period between 2009 and 2011

Treatment	Green manure	Manure maintenance
1	Calopo	100% conventional chemical manure + cattle manure
2	Calopo	Bokashi + Supermagro + 75% conventional chemical manure + cattle manure
3	Calopo	Bokashi + Supermagro + 50% conventional chemical manure + cattle manure
4	Calopo	Bokashi + Supermagro + 25% conventional chemical manure + cattle manure
5	No	100% conventional chemical manure + cattle manure
6	no	Bokashi + Supermagro + 75% conventional chemical manure + cattle manure
7	No	Bokashi + Supermagro + 50% conventional chemical manure + cattle manure
8	No	Bokashi + Supermagro + 25% conventional chemical manure + cattle manure

Source: Research data (2009)

3.2 Data collection

Data come from a research project called: "Avaliação do Sistema de Produção Integrada como alternative sustentável para o cultivo de rosas" – Evaluation of the Integrated Production System as a sustainable alternative to the cultivation of roses. It was approved by EPAMIG and performed at Risoleta Neves Experimental Farm (RNEF), located in São João del Rei, MG. Data regards the period between December 2009 and June 2011. The following projection was applied: 1 (one) rose production hectare (ha) considering 60.000 plants per hectare.

Data were used to calculate costs, expenses and financial feasibility indicators by means of the traditional method. All calculations were done with 100, 75, 50 and 25% chemical manure without calopo green manure (*Calopogonium mucunoides*) in consortium with the rosebushes.

3.3 Operationalizing the traditional method in order to analyze financial feasibility

The steps taken to use the traditional method to analyze financial feasibility can be described as follows:

- Determining the costs and expenses: variable cost approach – margin or direct –enabling the incorporation of direct costs to produced and manufactured products. The great advantage of applying such method lays on the use of the contribution margin concept. It is obtained by subtracting the costs and the expense variables from the price or sales incomes. Managers are able to identify products and services that have largely contributed to covering the fix costs and expenses, by applying the contribution margin concept (MARTINS, 2003);
- Setting the financial indicators: net liquid value (NPV) and the internal rate of return (IRR).

The net liquid value (NPV) in roses' cultivation by Integrated Production System was calculated by means of the following expression, according to Assaf Neto (2006):

$$NPV_K = \left[\sum_{t=1}^{t} \frac{R_t - D_t}{(1+k)^t} + \frac{S_t}{(1+k)^t} \right] - \left[I_0 + \sum_{t=1}^{T} \frac{I_t}{(1+k^*)^t} \right]$$

The internal rate of return (IRR) in rose's cultivation by Integrated Production System was calculated by means of the following expression, according to Assaf Neto (2006):

$$IRR = \sum_{t=1}^{t} \frac{R_t - D_t}{(1+r^*)^t} + \frac{S_t}{(1+r^*)^T} = I_0 + \sum_{t=1}^{T} \frac{I_t}{(1+r^*)^t}$$

Where: NPV = net liquid value; R_t= expected income or cash flow during the period (t); D_t= expected expenses or production costs during the period (t); S_t= investment's residual value in the end of the lifetime; K= discount rate or attractiveness; I_0= initial investment; I_t= incremental investments throughout the period; IRR = internal rate of return; r*= internal rate of return (TIR)

The current study considered the residual investment value as null. The project's mean lifetime was set on 7 years.

4 Discussing the Outcomes

4.1 Cost analysis for the rose's cultivation by Integrated Production System

Treatments 1, 2, 3 and 4 - as per table 1 -, show that variable costs were checked according to roses' cultivation with 100, 75, 50 and 25% of chemical and organic manure, along with calopo green manure (*Calopogonium mucunoides*) cultivated in consortium with the rose bushes.

The variable costs regarding all the analyzed treatments with pesticides and alternative treatments suffered no variations. On the other hand, chemical and organic manures under consecutive 25% reduction led to variations on variable costs' negative percentage (-6%, -10% and -17,98%) among treatments 1, 2, 3 and 4, respectively, according to data in table 1.

Among variable costs, direct man power shows higher percentage in all analyzed treatments – from 62 up to 75%. Therefore, its reduction might lead to reductions in total production costs.

Table 1 Variable costs on direct materials (DM), Packaging materials (PM) and direct man power (DMP) in one hectare roses' crop between December 2009 and June 2011 for treatments 1, 2, 3 and 4 - in consortium with green manure (*Calopogonium mucunoids*)

Direct Costs	**Treat. 1**	**Treat. 2**	**Treat. 3**	**Treat. 4**
Manure:				
- Chemical (DM)	R$27.745,02	R$20.810,52	R$13.830,10	R$ 6.937,76
- Organic (DM)	R$19.200,00	R$20.116,67	R$15.238,70	R$10.438,70
Pesticides:				
- Chemical (DM)	R$ 3.265,29	R$ 3.265,29	R$ 3.265,29	R$ 3.265,29
- Alternative (DM)	R$ 4.392,00	R$ 4.392,00	R$ 4.392,00	R$ 4.392,00
Packages (PM)	R$16.350,00	R$11.125,00	R$13.750,00	R$12.225,00
Direct man Power (DMP)	R$116.368,06	R$116.368,06	R$116.368,06	R$116.368,06
Total variable costs	**R$187.320,37**	**R$176.077,54**	**R$166.844,13**	**R$153.626,76**

Variable costs/dz.	**R$4,12**	**R$5,70**	**R$4,37**	**R$4,52**

Source: Research data.

Regarding treatments 5, 6, 7 and 8, as per data in table 2, variable costs were checked for rose cultivations with 100, 75, 50 and 25% of chemical and organic manure, although without calopo green manure (*Calopogonium mucunoides*) in consortium with the rosebushes. Negative percentage variations in variable costs were observed in 25% consecutive reduction treatments, totalizing -3.48%, -9.85% and -16.29% among treatments 5, 6, 7 and 8, respectively.

Table 2 Variable costs in direct materials (DM), packing material (PM) and direct man power (DMP) in one hectare rose crop between December 2009 and June 2011 for treatments 5, 6, 7 and 8 without consortium with green manure (*Calopogonium mucunoides*)

Direct costs	**Treat. 5**	**Treat.6**	**Treat.7**	**Treat. 8**
Manure:				
- Chemical (DM)	R$27.745,02	R$20.810,52	R$13.830,10	R$ 6.937,76
- Organic (DM)	R$19.200,00	R$20.116,67	R$15.238,70	R$10.438,70
Pesticides:				
- Chemicals (DM)	R$ 3.265,29	R$ 3.265,29	R$ 3.265,29	R$ 3.265,29
- Alternatives (DM)	R$ 4.392,00	R$ 4.392,00	R$ 4.392,00	R$ 4.392,00
Packaging (PM)	R$15.525,00	R$15.049,99	R$15.025,01	R$14.700,00
Direct man Power (DMP)	R$116.368,06	R$116.368,06	R$116.368,06	R$116.368,06
Total variable costs	**R$ 186.495,37**	**R$ 180.002,53**	**R$ 168.119,16**	**R$ 156.101,81**
Variable costs/dz.	**R$ 4,32**	**R$ 4,31**	**R$ 4,03**	**R$ 3,82**

Source: Research data

Due to 100% up to 75% chemical and organic manure reductions, there was a -11.02% negative variation in direct material costs. When the reduction went down from 100% to 50%, negative variation increased to -32.73%, whereas in reductions from 100% to 25% led to an expressive negative variation in direct materials' costs of -54.15%, according to data in Table 3.

All treatments present high percentages of chemical and organic manure within the direct material total costs' group, something around 80%, whereas chemical pesticides represent approximately 10% of costs with direct material in one hectare roses' production (Table 3).

According to direct costs' group such reductions on chemical and organic manures present high percentage variations, although direct costs participation represent 30; 27; 22 and 16% for treatments 1 and 5; 2 and 6; 3 and 7; 4 and 8, respectively.

Table 3 Costs with direct materials for one hectare roses' production in all treatments between December 2009 and June 2011

	Treatments							
	1 and 5 R$	**%**	**2 and 6 R$**	**%**	**3 and 7 R$**	**%**	**4 and 8 R$**	**%**
Manure:								
-Chemical	27.745,02	51	20.810,52	43	13.830,10	38	6.937,76	28
-Organic	19.200,00	35	20.116,67	41	15.238,70	41	10.438,70	42
Pesticides:								
Chemicals	3.265,29	6	3.265,29	7	3.265,29	9	3.265,29	13
Alternatives	4.392,00	8	4.392,00	9	4.392,00	12	4.392,00	17
Total	**54.602,31**	**100**	**48.584,48**	**100**	**36.726,09**	**100**	**25.033,75**	**100**

Source: Research data

It was observed that the presence or the absence of calopo green manure (*Calopogonium mucunoides)* was not relevant to the differences presented by the production variable costs in all the treatments. But actually, the relevance was found in the reduction of chemical and organic manures. They have led to high reductions in costs with direct material (variable costs), mainly when they came down from 100% to 25%.

Integrated production, since its conception, focused on a systemic view initially attacking plague integrated handling, going all the way up to the integration of all processes, ending over the whole production chain. Therefore, its implementation must be understood in a holistic way and structured over four pillars: organization of the productive base, sustainability system, processes' monitoring and information/data base, all components that integrate and consolidate other processes.

Roses' Integrated Production System was set and comprised by following such principles. Thus, due to field notebook notes, it was possible developing a data base able to give useful information to decision making processes. According to the current study, it was possible checking all the costs and expenses as well as the reductions in such items, in face of the reduction on the amounts of chemical and organic manures and the insertion of alternative or biological pesticides that showed low representativeness in total variable costs.

4.2 Financial Feasibility Analysis by traditional method in roses' cultivation by Integrated Production System

Financial feasibility indicators by traditional method, for treatments 1, 2 3 and 4 with calopo green manure (*Calopogonium mucunoides*) in consortium with the rosebushes were presented in table 4. It was observed that the NPVs in treatments 1, 3 and 4 were positive. However, treatment 2 shows negative NPV. NPV negative variations in treatment 2 were assigned to reductions on the amount of produced products, once it held calopo green manure (*calopogonium mucunoides*) in consortium with the rosebushes. It proved that reducing the amount of produced products, consequently reduces the outcomes, leading to negative NPVs.

Financial feasibility indicators by traditional method in treatments 5, 6 7 and 8 were shown in Table 5. It was observed that reductions on chemical and organic manure from 100 down to 75%, from 100 down to 50% as well as from 100% down to 25%, without calopo green manure (*calopogonium mucunoides*), did not influenced the NPVs in roses' cultivation by integrated production systems, once they were all positive and the variation percentages among them were low.

Table 4 Financial variable indicators in one hectare roses' cultivation by Integrated Production System in treatments: 1, 2, 3 and 4

Indicators	**Roses' Integrated Production**			
	Treat.1	**Treat.2**	**Treat.3**	**Treat.4**
Initial investment	(R$ 952.561,09)	(R$ 923.368,16)	(R$ 917.500,20)	(R$ 915.166,85)
Investment in Greenhouse	R$ 600.000,00	R$ 600.000,00	R$ 600.000,00	R$ 600.000,00
Hurdle rate	12%	12%	12%	12%
IRR	**34,34%**	**10,99%**	**26,54%**	**19,32%**
NPV	**R$ 756.900,54**	**(R$ 29.291,31)**	**R$ 458.980,93**	**R$ 222.058,97**

Source: research data

Thus - regarding products about to adhere to integrated production systems - there is a possibility to reduce external inputs by reducing direct costs, without jeopardizing production or productivity. The integrated production system applied to rose crops is feasible, even in face of 75% reduction on chemical and organic manures. It was shown the IRR of 36.6%a.a. and the NPV of R$668.380,56, in treatment 8, as per Table 5.

Table 5 Financial feasibility indicators in one hectare roses' cultivation by integrated production system, in treatments: 5, 6, 7 and 8

Indicators	**Roses' Integrated Production**			
	Treat.5	**Treat.6**	**Treat.7**	**Treat.8**
Initial investment	(R$ 922.069,01)	(R$ 919.735,66)	(R$ 917.402,30)	(R$ 915.068,95)
Investment in greenhouse	R$ 600.000,00	R$ 600.000,00	R$ 600.000,00	R$ 600.000,00
Hurdle rate	12%	12%	12%	12%
IRR	**32,17%**	**30,56%**	**32,88%**	**36,67%**
NPV	**R$ 655.823,57**	**R$ 597.909,70**	**R$ 677.493,44**	**R$ 668.380,56**

Source: research data

According to the financial feasibility indicators by traditional method presented in Table 5, NPV and IRR in treatments 5, 6, 7 and 8 are feasible. Thus, the Integrated Production System - besides leading to good agricultural practices (GAP) -, sets biological, technical and chemical control, leading to a stable balance of inputs and enables: reducing costs and expenses, protecting the environment, respecting social matters and is also financially feasible.

5 Considerations and conclusion

Financial analysis by traditional method in treatments 1, 3 and 4 showed high internal rates of return in comparison to what are considered minimum attractiveness rates. Treatment 2 presented low internal rates of return in comparison to the same rates. Variations were seen in net liquid values and internal rates of return among such treatments. Variations can be explained by the consortium with calopo green manure (*Calopogonium mucunoides*). It could have happened because of combination of it and the rosebushes, consequently reducing production and productivity. Green manure leads to long term positive outcomes, bringing benefits to soil's chemical, physical and biological properties, by the decomposition and the fixation of biological nitrogen.

Treatments 5, 6, 7 and 8 presented 25% consecutive reductions on chemical and organic manures without calopo green manure (*calopogonium mucunoides*). Internal rates of return and net liquid values presented themselves as feasible in all the treatments. Thus, 25% consecutive reductions in chemical and organic manures without green manure did not lead to significant variations in the financial feasibility indicators in roses' cultivation by integrated production system, among treatments.

Thus, it is possible concluding that producers can make an option for integrated production systems in roses' cultivation with 25% reductions in chemical and organic manures. They were assigned as financially feasible by traditional method, besides being environmentally correct and socially fair.

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