

TECHNICAL ARTICLE

Gladiolus as an alternative for diversification and profit in small rural property

Lilian Osmari Uhlmann^{1*}, Camila Coelho Becker¹, Regina Tomiozzo¹, Nereu Augusto Streck¹, Alfredo Schons², Darlan Scapini Balest¹, Mara dos Santos Braga¹, Natalia Teixeira Schwab¹, Josana Andreia Langner¹

Abstract

Flower crops are an alternative for diversification in small farms, being gladiolus an option of cut flower. The objective of this study was to disseminate the gladiolus crop as an alternative for diversification and profit for small farms through an extension project where crop management practices were demonstrated during its development cycle. An extension project was carried out in partnership with a rural extension agency, EMATER/RS-ASCAR, to identify the farmers interested in diversifying their production system for growing gladiolus. The extension project was developed in four counties in the Central region of the Rio Grande do Sul/Brazil. Together with the extensionists of EMATER/RS-ASCAR, farmers were assisted during the entire production cycle and learned the management practices from planting to harvesting. Altogether, approximately 2,400 gladiolus spikes were produced, which were marketed one week before and during Mother's Day week at local fairs. In all the counties, the demand and consumption of the flower stems were high, demonstrating acceptance of the consumers of gladiolus stems on Mother's Day. The gladiolus production has proven to be profitable for small family properties. This system encourages the production in short-chains, contributes to the growth of local flower production and may contribute for decreasing rural exodus and sustainability for future generations.

Keywords: *Gladiolus x grandiflorus*, rural extension, Mother's Day, production planning, floriculture.

Resumo

A cultura do gladiolo como alternativa de diversificação e renda na pequena propriedade familiar

O cultivo de flores é uma alternativa de diversificação de produção e renda para as propriedades familiares, sendo o gladiolo uma opção de flor de corte. O objetivo deste trabalho foi divulgar a cultura do gladiolo como alternativa de diversificação e renda para pequenos produtores rurais através de um projeto de extensão onde foram demonstradas as técnicas de manejo da cultura durante o seu ciclo de desenvolvimento. Para isso, foi firmada uma parceria com a instituição de extensão rural EMATER/RS-ASCAR, com o intuito de identificar produtores interessados em cultivar o gladiolo em suas propriedades. O projeto de extensão foi desenvolvido em cinco municípios da região da Depressão Central do Rio Grande do Sul. Juntamente com os extensionistas da EMATER/RS-ASCAR, foi acompanhado o ciclo de desenvolvimento do gladiolo, indicando aos produtores as principais técnicas de manejo do plantio à colheita. Ao todo, foram produzidas aproximadamente 2400 hastes de gladiolo, que foram comercializadas em feiras locais no Dia das Mães. Em todos os locais houve grande procura e consumo das hastes florais, demonstrando aceitação do consumidor por hastes de gladiolo para o Dia das Mães. Esta atividade demonstrou ser rentável aos produtores familiares. Este sistema de produção incentiva a produção em cadeias curtas, contribui para o crescimento da produção local de flores e pode contribuir para diminuir o êxodo rural e a sustentabilidade das futuras gerações no campo.

Palavras-chave: *Gladiolus x grandiflorus*, extensão rural, Dia das Mães, planejamento da produção, floricultura.

Introduction

Floriculture is a promising branch of Brazilian agribusiness, and in 2017, it presented an average growth of 7% and the expectation for 2018 is a growth of around 4% (Junqueira and Peetz, 2018). Brazilian flower consumption is concentrated on special occasions and

dates, contrary to that observed in developed countries, where commercialization takes place throughout the year (IBRAFLOR, 2017). The major demand for flowers in Brazil is in the celebrations of Mother's Day, Valentine's Day, Christmas, New Year's Day, International Women's Day, Secretary's Day, Fathers's Day and All Souls' Day. But, this scenario may change as new segments consumers

¹ Universidade Federal de Santa Maria (UFSM), Departamento de Fitotecnia, Santa Maria-RS, Brazil. *corresponding author: uhlmannlilian@gmail.com.

² EMATER-RS/ASCAR, Regional de Santa Maria, Santa Maria-RS, Brazil.

are emerging in Brazil (Junqueira and Peetz, 2017), as local consumers with lower incomes who wish to consume flowers more frequently, but have lower purchasing power.

The cultivation of flowers and ornamental plants is one of the most profitable activities of farm, but there are many challenges in the field, such as the difficulty of adapting to market demands regarding the quality standards of the products, the need for specialized labor and the high production costs (Junqueira and Peetz, 2014). Thus, farmers need technical guidance for production planning and management practices. As a result, rural extension activities that bring the information to farmers have the potential to offer assistance and contribution to the diversification of species farmed on family farms.

In the southern region of Brazil, there was an increase in the number of flower producers from 2008 to 2013, especially due to the increase in the supply of products due to the growth of regional centers, where Rio Grande do Sul is the largest producer (Junqueira and Peetz, 2014). According to Souza et al. (2008), in the central region of RS, consumers prefer to purchase local products, mainly due to the better quality of the product, due to the shorter transport time. However, local production meets only 20% of demand (Menegaes et al., 2015). An alternative to meet this demand and stimulate the increase in flower

consumption is the local production and marketing at fairs, as the chain shortening has the potential to reduce the cost to the final consumer. Additionally, flower cultivation as an alternative for diversification and profit crop for small rural farms plays a key role in rural exodus reducing, especially among young people, and in the sustainability of future generations in the countryside.

The cultivation of gladiolus or Palma-de-Santa-Rita (*Gladiolus x grandiflorus* Hort.) has potential for expansion in RS, since it is easy to implant and manage, the crop adapts to the edaphoclimatic conditions of the state and can be cultivated in open field, reducing production costs, attractive features for the small family producer. In Brazil, All Souls' Day is the main date for the commercialization of gladiolus (Schwab et al., 2015a) and, because of this cultural factor, many farmers believe that cultivation of this species is possible only in late winter and early spring (July, August and September). However, the late summer and early autumn (February, March and April) is also a suitable period for the production of quality flower stems (Schwab et al., 2015b). In the RS, the demand for gladiolus has been increasing in different celebratory dates, such as Mother's Day, Women's Day and also for the ornamentation of interiors, parties and events (Schwab et al., 2018). These different forms of use as cut flowers are shown in Figure 1.



Figure 1. Different uses of gladiolus flowers stems: events ornamentation (A), and interior decoration (B).

One of the factors that prevents the expansion of the gladiolus in RS is the difficulty in determining the date of planting of the corms to harvest the floral stems at the desired date (Uhlmann et al., 2017). Environmental factors, such as air temperature, have a great influence on the length of the gladiolus development cycle, and for the State of Rio Grande do Sul, early-cycle cultivars have a cycle ranging from planting to harvest between 69 to 121 days, (Becker et al., 2017). It is important to use tools such as mathematical models to determine the optimal planting date (Becker et al., 2017). A

developmental model called PhenoGlad was proposed to simulate the development of the gladiolus culture and was calibrated and validated with data from field experiments conducted over several years and at different locations in Rio Grande do Sul and Santa Catarina states (Uhlmann et al. 2017).

The objective of this study was to disseminate the gladiolus crop as an alternative of diversification and profit for small farms through an extension project where crop management practices were demonstrated during its development cycle.

Material and Methods

The first phase of the extension project, carried out from October 2017 to January 2018 involved the survey of farmers interested in diversifying their production system and cultivating gladiolus in their properties. This survey was carried out by extension workers of EMATER/RS-ASCAR, Santa Maria Regional, which covers 35 counties in the central region of RS. The criteria for selection were that they be small farmers willing to diversify their production system

and have a place to market the flowers. Six small family farmers were selected to market their products at local fairs in the counties of Cachoeira do Sul (2 farmers), Dilermando de Aguiar, Nova Palma, Santa Maria and Santiago (Figure 2). The choice of only six farmers in this first phase of the project was due to the fact that it was a number of farmers that the Team could follow the production, and also because, as it consisted of a pilot project, it was necessary to know the market to verify the acceptance of the flowers by consumers before expanding the project to more farmers.

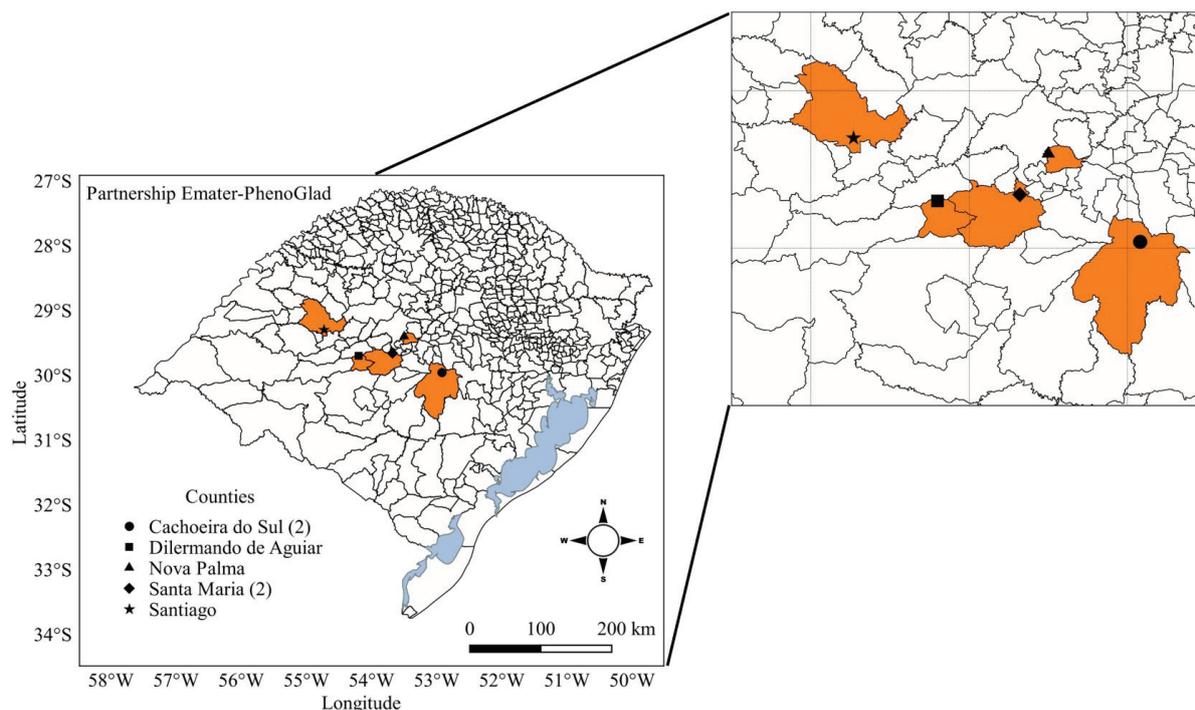


Figure 2. Map of Rio Grande do Sul/Brazil with the five counties (Cachoeira do Sul, Dilermando de Aguiar, Santa Maria, Santiago, and Nova Palma) where the commercial farm were assisted.

Source: Authors.

After the selection of the farmers, a technical visit to the farms was carried out by the members of the PhenoGlad Team (research and extension team composed by professors and undergraduate and graduate students) and the EMATER/RS-ASCAR extension agents of the regional office of Santa Maria and the municipal office. During the visits, production planning was done that the stems were ready to be marketed on Mother's Day 2018, as well as guidance on crop management techniques. Approximately every two weeks the team of teachers, students and extension workers made visits to the farmers to carry out and teach the management practices of the gladiolus during the cultivation period, from February to May 2018. During the first visit the area was prepared, confection of beds with 1 m of width and 25 m of length and planting of the corms. Planting dates were determined using PhenoGlad version 1.1 (Uhlmann et al., 2017), aiming at the commercialization of flower stems on Mother's Day, 2018, which was on May 13. A folder of gladiolus culture was prepared by the PhenoGlad Team, containing basic management information, cultivars and planting season, was also made available to farmers.

The planting date for the different counties was determined that the flower stems reached the point of harvest, the so called the R2 stage of the scale of Schwab et al. (2015a), when the first three florets of the spike show the color, three days before Mother's Day, to offer the consumer stems with some open flowers. This criterion was adopted that the farmers had time to harvest the flower stems and to make the packs with the buttons still closed, causing less damage to the florets, and providing stems with better quality.

Each family received a total of 250 commercially available gladiolus corms, 50 of each cultivars White Goddess (white color), Rose Supreme (pink color), Red Beauty (red color), Jester (yellow and red color) and Fidelio (pink color). These cultivars were selected by the variety of colors and due to the intermediate II developmental cycle, which has duration of 78 to 131 days from planting to harvest (Uhlmann et al., 2017). During the crop development cycle, farmers were advised on the correct timing of management techniques in the field, such as cover fertilization, heaping, weeding, weed control, diseases and insects. Near the

harvest date, attention was paid to the crops in order to help farmers identify the picking point of the flower stems, the way of harvesting, storage and transport of the stems to the place of sale.

Results and Discussion

The recommended planting date by the PhenoGlad software for cultivars varied between the counties, being

earlier for Cachoeira do Sul (13 to 17/02, DD/MM) and later for the others (Dilermando de Aguiar, Santa Maria, and Santiago), 18 to 22/02 (DD/MM, Table 1). This variation occurred because Cachoeira do Sul is in a region colder than the other counties and the air temperature is the main climatic factor that controls the development cycle of the gladiolus (Shilto and Halevy, 1976; Streck et al., 2012; Uhlmann et al., 2017). Thus, in that region, the planting was anticipated.

Table 1. Planting date (DD/MM/YYYY) held in the field for different gladiolus cultivars in four counties, recommended planting date by the PhenoGlad software, observed data of R2 stage in the field and simulated by PhenoGlad software.

Cultivar*	Planting date	Recommended planting date	Observed R2 stage	Simulated R2 stage
Cachoeira do Sul				
White Goddess	15/02/2018	13 a 17/02	02/05/2018	10/05/2018
Rose Supreme	15/02/2018	13 a 17/02	01/05/2018	10/05/2018
Red Beauty	15/02/2018	13 a 17/02	01/05/2018	10/05/2018
Jester	15/02/2018	13 a 17/02	03/05/2018	10/05/2018
Dilermando de Aguiar				
White Goddess	14/02/2018	18 a 22/02	08/05/2018	10/05/2018
Rose Supreme	14/02/2018	18 a 22/02	06/05/2018	10/05/2018
Red Beauty	14/02/2018	18 a 22/02	07/05/2018	10/05/2018
Jester	14/02/2018	18 a 22/02	07/05/2018	10/05/2018
Santa Maria				
White Goddess	16/02/2018	18 a 22/02	09/05/2018	10/05/2018
Rose Supreme	16/02/2018	18 a 22/02	30/04/2018	10/05/2018
Red Beauty	16/02/2018	18 a 22/02	02/05/2018	10/05/2018
Jester	16/02/2018	18 a 22/02	07/05/2018	10/05/2018
Santiago				
White Goddess	19/02/2018	18 a 22/02	07/05/2018	10/05/2018
Rose Supreme	19/02/2018	18 a 22/02	05/05/2018	10/05/2018
Red Beauty	19/02/2018	18 a 22/02	07/05/2018	10/05/2018
Jester	19/02/2018	18 a 22/02	10/05/2018	10/05/2018
Nova Palma**				
White Goddess	15/02/2018	18 a 22/02	-	10/05/2018
Rose Supreme	15/02/2018	18 a 22/02	-	10/05/2018
Red Beauty	15/02/2018	18 a 22/02	-	10/05/2018
Jester	15/02/2018	18 a 22/02	-	10/05/2018

* Phenology of the Fidelio cultivar was not observed in the field due to the unevenness of the plants.

** In the Nova Palma county, the observed R2 stage was not collected.

The corms planting was carried out on the farms together with the farmers (Figure 3A). Farmers who had the organic fertilizer (manure), applied this before planting at the time of beds preparation, as was the case of the farmer in the county of Dilermando de Aguiar. In this county, organic fertilization was supplemented with chemical fertilizer (500 kg.ha⁻¹ of 5-20-20 NPK), which was applied in the planting rows. In the other crops, only the chemical fertilization was used. No soil analysis was performed on the different

properties to define the fertilizer dosage, but a standard dose that had previously been used in crop research was used. The fertilizer was placed at approximately 15 cm depth and covered with a soil approximately 5 cm, to avoid direct contact of the fertilizer with the corms. The corms were planted at a 10 cm depth, spaced 20 cm between corms and 40 cm between paired rows.

After the plant's emergence (VE), the farmers were instructed to cut the sprouts at the base of the plant, leaving

at most two sprouts. This practice is necessary because each gladiolus' corm has the capacity to generate, from its buds, one to five sprouts, depending on the cultivar. Each sprout generates a floral stem and many sprouts per plant can delay the cycle and produce smaller stems due to the increase of the number of drains and competition in the plant, causing loss of the floral stems quality, crop unevenness and consequent delay of the commercialization, which is disadvantageous for the farmer who wishes to market on a specific date. Maintaining two sprouts will obtain only two flower stems per corm, but there will be gain in product quality, as the flower stems will be larger and will have a longer shelf life, due to the greater number of florets, attracting the attention of the consumers (Schwab et al., 2014).

Approximately 30 days after planting (from 11 to 17/03/2018, DD/MM/YYYY), a new technical visit was made to the crops to do the nitrogen fertilization in the cultivars that were with three leaves (V3 stage) (Figure 3B) of the phenological scale of Schwab et al. (2015a), which has eight vegetative stages and eleven reproductive stages. Performing the nitrogen fertilization in the V3 stage is fundamental, because, at this stage, the differentiation of the floral stem is taking inside the plant whorl, which constitutes a strong nitrogen drain (Schwab et al., 2015a). The urea dose (46% N) applied was 350 kg ha⁻¹. At the time of application and incorporation of this fertilizer, the farmers were instructed to carry out the soil heaping near the plants, to give them more support and to control weeds.

The next management technique that was recommended to the farmers was the plant support. This practice aims to support the plant, which can fall due to the size and weight of the flower stems. It is also important to keep the stems upright avoiding the formation of tortuous stems. The placement of the first wire to support was performed during the week visit from 08 to 14/04/2018 (DD/MM/YYYY), approximately 60 days after planting (Figure 3C), when most of the plants were between V6 - V7 stage (with six to seven leaves) (Schwab et al., 2015a). The wire was attached to bamboo stakes previously fixed to the ends of the beds, and a wire was placed on each side of the planting rows. During this visit, it was emphasized the importance of keeping plants in good phytosanitary status and the need to carry out control as soon as the first symptoms of disease and pest attack appeared. *Uromyces transversalis* and caterpillars are the main biotic factors affecting crop

growth. With the help of the EMATER/RS-ASCAR extension workers, farmers were encouraged to use alternative disease control products, such as the Bordeaux syrup, since many of them did not use agrochemicals in the crop. This alternative control was used preventively in all the crops and its use presented good control of the diseases, not interfering negatively in the quality of the stems. There was no need to carry out caterpillars' control.

In the week before Mother's Day, from 29/04 to 05/05/2018 (DD/MM/YYYY), approximately 80 days after planting, the last visit was made to all properties (Figure 3D). In the crops, some cultivars were already at harvest point, according to the average date of R2 observed for the different cultivars in the four counties (Table 1). Even the model programming being carried out with the objective of all cultivars reaching the R2 stage three days before Mother's Day, there is a temperature difference between the sites and a difference in the cycle duration of the cultivars, even if all are classified as being from the Intermediate II cycle. Among the localities, Cachoeira do Sul was where the stems were more advanced and in Nova Palma, when the team has visited the cultivation, few stems were in R2, because of that, the date of the R2 was not observed in this county. Among the cultivars, the cultivar Rose Supreme was the first to reach R2 in most of the properties. The R2 date of the Fidelio was not collected, because the plants were much ununiformed since this cultivar did not adapt to the cultivation in the region. As not all stems were in R2 on the visit' day, the quantitative parameters of stem quality, such as length and diameter, were not measured.

The farmers were instructed on how to identify the harvesting point of the flower stems and how to harvest the stem to leave 4 to 5 leaves on the plant in the field for a period of at least 45 days. This practice is recommended for farmers who want to harvest the corms and use them in the next harvest and therefore the maintenance of the leaves on the plant is necessary for the photoassimilates production for the new-corm' growth (Paiva et al., 2012). After flower stems harvesting, the growers were instructed to make small bouquets and keep them upright in a container with water. Also, during the visit, each family received a poster with the identification "participating farmers" (name or surname) and county, with the purpose of the consumers to identify, in the fairs, the farmers participating in the project and, thus, to assist in the commercialization.



Figure 3. Technical visits to the gladiolus farms when were carried out planting (A), nitrogen fertilization, about 30 days after planting (B), support plants vertically with plastic net, about 60 days after planting (C) and harvest, about 80 days after planting (D).

As not all plants reached R2 on the same day, as the flowering period occurs within 15 days, farmers took the first stems to the fair one week before Mother's Day. An alternative for farmers with cold rooms in the property is the storage of the stems at low temperatures (approximately 6°C) to delay the opening of the florets until the day before the day of sale (Schwab et al., 2015b). However, since none of the farmers had a cold room, they started marketing at the fairs about a week before the intended date, using them as an attraction for consumers to return to the fair next week to buy flowers for Mother's Day.

In all, approximately 2400 gladiolus stems were produced among the six farmers of the five counties (an average of 400 stems per commercial crop), which were marketed during Mother's Day week. The commercialization at the fairs was followed in the five counties on Thursday, Friday, and Saturday of the eve of Mother's Day (Figure 4).

The commercialization form and the sale value were determined by each farmer, according to their market experience and supply/demand ratio of the county. In Cachoeira do Sul (Figure 4A and 4B), the stems were sold at a price of R\$2.00 (US\$ 0.50) per unit or in bouquets with three stems at price of R\$5.00 (US\$ 1.25). In Dilermando de Aguiar and Santa Maria (Figure 4C and 4D, respectively), were sold in bouquets with three stems at price of R\$ 5.00 (US\$ 1.25). In Santiago (Figure 4E) bouquets were made with three stems accompanied by green leaves and adornments that added value to the product, each bouquet being sold for R\$12.50 (US\$3.12). In Nova Palma, farmers were not marketers, and the sale was made by home delivery at a price of R\$ 1.00 (US\$0.50) per stem, together to the strawberries' sale (Figure 4F).



Figure 4. Commercialization of gladiolus floral stems for Mother's Day in the fairs in Cachoeira do Sul (A, B), Dilermando de Aguiar (C), Santa Maria (D), Santiago (E), and Nova Palma (F) counties, Rio Grande do Sul/Brazil.

As at local fairs the farmers do not have to follow the strict quality standards, the farmers were able to adopt strategies to commercialize all the production, including the smaller stems, by making packages containing a greater number of stems. The cost of production in each crop was approximate R\$ 364.00 (US\$91.00), including the purchase of corms, fertilizer, raffia wire for support and labor. As each farmer determined the sale price of the gladioli and the number of sold stems was not accurately accounted, it was not possible to determine the profit that each farmer obtained with their production.

The consumers' acceptance was high, which resulted in the commercialization of all stems in the five counties. According to reports from the farmers, the experience was positive both in the production and the commercialization aiming this special date, since they were able to learn about the techniques of crop cultivation, beautifying the property and adding profit. Consumers were surprised to find gladiolus stems for the Mother's Day because the most

common is the offer on the All Souls' Day. The success of the gladiolus production for this commemorative date demonstrates the need for investment in the regionalization of flower production, for its importance in generation of new employment opportunities, occupation of the labor force and shortening of chains, through the reduction of transportation at medium and long distances (Junqueira and Peetz, 2018).

To conclude the first phase of the project, a technical meeting was held to evaluate and plan future actions, with farmers and extension agents (Figure 5). At the time, all gave their testimony on the experience of producing gladiolus stems for Mother's Day. According to the reports, the experience was positive both in the production and in the commercialization. It was verified the great interest of the consumers for local production flowers for use in the residence's decoration, mainly because it is a quality and low-cost product that can be acquired weekly in the fair, along with the vegetables.

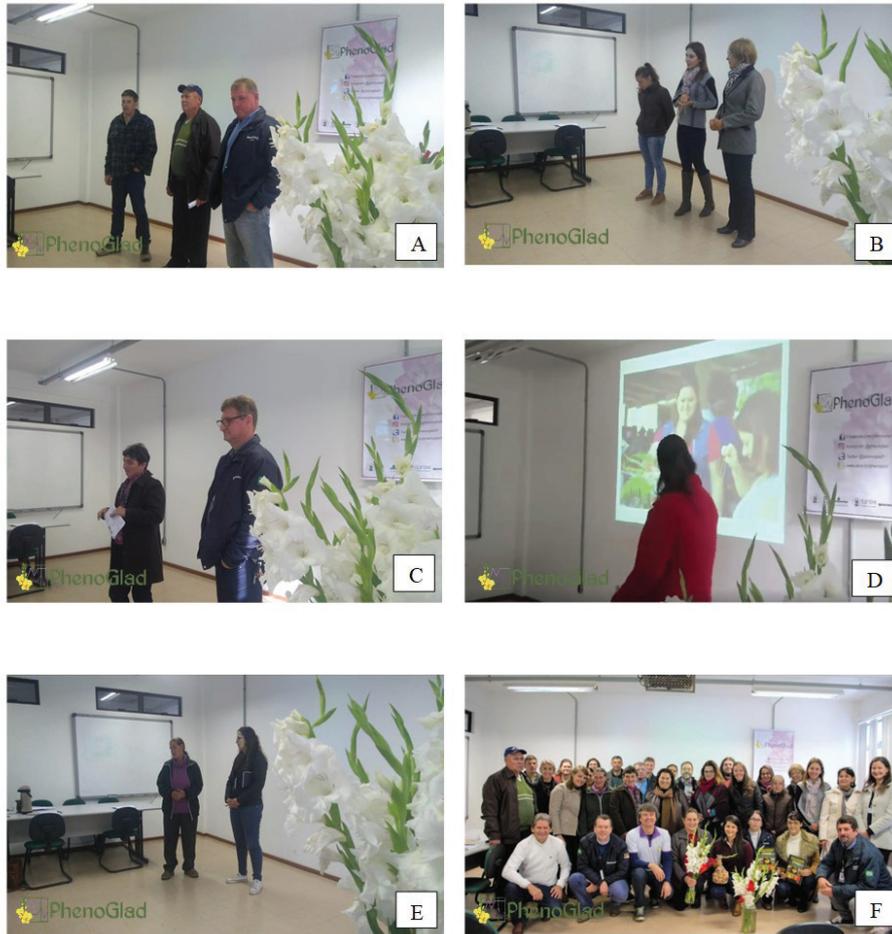


Figure 5. Evaluation technical meeting and planning of the next phase of the project with farmers and extension of EMATER-RS/ASCAR: reports of the extensionists and farmers of the Cachoeira do Sul, Dilermando de Aguiar, Nova Palma, Santiago, and Santa Maria cities, respectively (A, B, C, D and E) and farmers, extensionists and PhenoGlad Team (F).

This meeting also defined the project expansion, aiming the production of floral stems for the All Souls' Day in 2018, in the counties of Cachoeira do Sul (3 families and in an agricultural school), Dilermando de Aguiar (2 families), Nova Palma (1 family), Santiago (1 family), Santa Maria (1 family) and included in the project farmers of Itaara (2 families), Formigueiro (2 families), São João de Polêsine (2 families) and Júlio de Castilhos (in an agricultural school). This project showed scope beyond the Central Depression of RS, with potential for expansion to other regions of the state.

Conclusions

The gladiolus is a cut flower that can be part of the production system of small farmers of the RS state, as an alternative for diversification, aggregation of value and profit.

The extension project showed that gladiolus flower stems have a consumer market outside All Souls' Day, in the region of the study, breaking the paradigm of

gladiolus as a flower to decorate cemeteries and funeral celebrations.

The gladiolus stems commercialization at local fairs reduces the cost to the final consumers, as well as providing access to a better product quality.

This small-scale production system with local marketing of the products encourages production in short chains and contributes to the growth of local flower production.

Author Contribution

L.O.U. 0000-0001-9142-4201: the conception of work, collection, analysis, and interpretation of data, writing and critical review of the article. C.C.B.: the conception of work collection, analysis, and interpretation of data, writing and critical review of the article. R.T.: the conception of work, collection, analysis, and interpretation of data, writing and critical review of the article. N.A.S.: the work supervisor, the conception of work collection, analysis, and interpretation of data, writing and critical review of the article. A.S.: the conception of work, collection, analysis, and

interpretation of data, writing and critical review of the article. D.S.B.: collection, analysis, and interpretation of data, writing. M.S.B.: collection, analysis, and interpretation of data, writing. N.T.S.: the work supervisor, the conception of work, collection, analysis, and interpretation of data, writing and critical review of the article. J.A.L.: collection, analysis, and interpretation of data, writing and critical review of the article.

Acknowledgments

The authors are thankful to “EMATER/RS-ASCAR”, Santa Maria Regional, counties of Cachoeira do Sul, Dilermando de Aguiar, Santiago and Nova Palma, to extension workers and farmers of the respective counties, for having accepted to participate in the extension project. To “Conselho Nacional de Desenvolvimento Científico e Tecnológico” (CNPq), Proc. N. 140544/2016-0 and Proc. N. 302524/2011-8 and “Fundo de Incentivo à Extensão” (FIEEX) from Universidade Federal de Santa Maria, for the extension scholarships.

References

- BECKER, C. C.; STRECK, N. A.; UHLMANN, L. O.; RIBEIRO, B. S. M. R.; TOMIOZZO, R. SILVEIRA, W. B.; BENEDETTI, R. P.; CHARÃO, A. S.; BALEST, D. S.; SCHWAB, N. T.; BACKES, F. A. A. L.; BELLÉ, R. 2017. **Zoneamento da data de plantio de gladiolo para comercialização no Dia de Finados e no Dia das Mães no Rio Grande do Sul**. Disponível em: < <http://www.cropmodels.ufsm.br/download/3019/> >. Acesso em: 27 jul. 2018.
- IBRAFLOR. 2017. **O mercado de flores no Brasil**. Disponível em: <<https://www.ibraflor.com.br/>> Acesso em: 23 jul. 2018.
- JUNQUEIRA, A.H.; PEETZ, M.S. O setor produtivo de flores e plantas ornamentais do Brasil, no período de 2008 a 2013: atualizações, balanços e perspectivas. **Ornamental Horticulture**, v.20, n.2, p.115-120, 2014.
- JUNQUEIRA, A.H.; PEETZ, M.S. Brazilian consumption of flowers and ornamental plants: habit, practices and trends. **Ornamental Horticulture**, v.23, n.2, p.178-184, 2017. DOI: <http://dx.doi.org/10.14295/oh.v23i2.1070>
- JUNQUEIRA, A.H.; PEETZ, M.S. Sustainability in Brazilian floriculture: introductory notes to a systemic approach. **Ornamental Horticulture**, v.24, n.2, p.155-162, 2018. DOI: <http://dx.doi.org/10.14295/oh.v24i2.1253>
- MENEGAES, J.F.; BACKES, F.A.A.L.; BELLÉ, R.A.; BACKES, R.L. Diagnóstico do mercado varejista de flores de Santa Maria, RS. **Ornamental Horticulture**, v.21, n.3, p.291-298, 2015.
- PAIVA, P.D.O.; FERNANDES, K.D.; CERATTI, M. Gladiolo. In: PAIVA, P.D.O.; ALMEIDA, E.F.A. **Produção de flores de corte**. Lavras: Editora UFLA, 2012. p.448-470.
- SCHWAB, N.T.; STRECK, N.A.; LANGNER, J.A.; RIBEIRO, B.S.M.R.; UHLMANN, L.O.; BECKER, C.C. Aplicabilidade do termo antocrono para representar a velocidade de abertura de flores em inflorescência. **Pesquisa Agropecuária Brasileira**, v.49, n.9 p.657-664, 2014. DOI: 10.1590/S0100-204X2014000900001
- SCHWAB, N.T.; STRECK, N.A.; BECKER, C.C.; LANGNER, J.A.; UHLMANN, L.O.; RIBEIRO, B.S.M.R. A phenological scale for the development of Gladiolus. **Annals of Applied Biology**, v.166, n.3 p.496-507, 2015a. DOI: 10.1111/aab.12198
- SCHWAB, N.T., STRECK, N.A., RIBEIRO, B.S.M.R., BECKER, C.C., LANGNER, J.A., UHLMANN, L.O.; RIBAS, G.G. Parâmetros quantitativos de hastes florais de gladiolo conforme a data de plantio em ambiente subtropical. **Pesquisa Agropecuária Brasileira**, v.50, n.10, p.902-911, 2015b. <http://dx.doi.org/10.1590/S0100-204X2015001000006>
- SCHWAB, N.T.; STRECK, N.A.; UHLMANN, L.O.; BECKER, C.C.; RIBEIRO, B.S.M.R.; LANGNER, J.A.; TOMIOZZO, R. Duration of cycle and injuries due to heat and chilling in Gladiolus as a function of planting dates. **Ornamental Horticulture**, v.24, p.163-173, 2018. DOI: <http://dx.doi.org/10.14295/oh.v24i2.1174>
- SHILLO, R.; HAVELY, A.H. The effect of various environmental factors on flowering of gladiolus. III. Temperature and moisture. **Scientia Horticulturae**, v.4, p.147-155, 1976. DOI: 10.1016/S03044238(76)800064.
- SOUZA, R.S.; ARBAGE, A.P.; NEUMANN, P.S.; FROEHLICH, J.M.; DIESEL, V.; SILVEIRA, P.R.; SILVA, A.; CORAZZA, C.; BAUMHARDT, E.; LISBOA, R.S.; Comportamento de compra dos consumidores de frutas, legumes e verduras na região central do Rio Grande do Sul. **Ciência Rural**, v.38, n.2, p.511-517, 2008. DOI: <http://dx.doi.org/10.1590/S0103-84782008000200034>.
- STRECK, N.A.; BELLÉ, R.A.; BACKES, F.A.A.L.; GABRIEL, L.F.; UHLMANN, L.O.; BECKER, C.C. Desenvolvimento vegetativo e reprodutivo em gladiolo. **Ciência Rural**, v.42, n.11, p.1968-1974, 2012.
- UHLMANN, L.O.; STRECK, N.A.; BECKER, C.C.; SCHWAB, N.T.; BENEDETTI, R.P.; CHARÃO, A.S.; RIBEIRO, B.S.M.R.; SILVEIRA, W.B.; BACKES, F.A.A.L.; ALBERTO, C.M., MUTTONI, M., PAULA, G.M., TOMIOZZO, R., BOSCO, L.C., BECKER, D. PhenoGlad: A model for simulating development in Gladiolus. **European Journal of Agronomy**, v.82, Part A, p.33-49, 2017. DOI: <http://dx.doi.org/10.1016/j.eja.2016.10.001>