

2. znanstvena konferenca z mednarodno udeležbo

Konferenca VIVUS – s področja naravovarstva, kmetijstva, hortikulture in živilstva

»ZNANJE IN IZKUŠNJE ZA NOVE PODJETNIŠKE PRILOŽNOSTI«

24. in 25. april 2013, Biotehniški center Naklo, Strahinj 99, Naklo, Slovenija

2nd Scientific Conference with International Participation

Conference VIVUS – Environmentalism, Agriculture, Horticulture, Food Production and Processing

»KNOWLEDGE AND EXPERIENCE FOR NEW ENTREPRENEURIAL OPPORTUNITIES«

24th – 25th April 2013, Biotechnical Centre Naklo, Strahinj 99, Naklo, Slovenia

Contemporary production of annual flowers in continental and Mediterranean Croatia

Ines Pohajda

Agricultural Advisory Service, Republic of Croatia, ines.pohajda@savjetodavna.hr

Dean Vaci

Polytechnic of Rijeka, Study of Mediterranean Agriculture, Republic of Croatia,
dean.vaci@gmail.com

Abstract

Annual flowers production in Croatia is significantly higher compared with other groups of flowers production, which resulted in a recognizable and supply of domestically grown annual flowers in the Croatian market. Annual flowers from the local production mostly are mostly sold on local markets, and then on the doorsteps, commemorative local sales and events, and the smallest share of the market is through retail chains. The most common types of annual flowers, which are present in domestic production, are: *Begonia semperflorens*, *Salvia splendens*, *Ageratum houstonianum*, *Impatiens wallerana*, *Tagetes patula* and *Zinnia elegans*. This study included a survey of techniques for growing six types of annual flowers in continental and Mediterranean climates by modern agricultural subjects. Determining the optimal planting dates, picking out, planting and care in conditions of annual flowers continental and Mediterranean climate will enable better planning of the local production. Successfully connecting producers of annual flowers from continental and Mediterranean regions of Croatia would meet the requirements of modern market competitiveness. It will ensure further strengthening of domestic production of annual flowers and survival on European markets.

Key words: flowers production, annuals flowers, flowers marketing, competitiveness of annual flowers

1 Introduction

Flower production on family farming estates in the Republic of Croatia has become more and more important for the last ten years. Younger farmers are connected with this occupation, and demand for the flowers from local production is increased. The reason for this situation can be found in the support of the local government which points out importance of the floral events which advertise and require locally produced flowers. The greatest amount of flowers is being produced in the north-south Croatia, and the Varaždin county covers the biggest number of the flower producers. On the other hand, in the continental Croatia, climatic conditions have influence on the greater investments into the flower production in relation to production in conditions of Mediterranean climate. That's why it is very important to make comparison of

production of the flowers in conditions of continental climate with conditions in the Mediterranean, aiming to connect producers and satisfy demands of Croatian market. When considering the flower production in Croatia, the first place is taken by production of annual flowers. Annual flowers include a group of plants which, inside one vegetation period, is sown, germinated and achieved full development i. e. makes leaves and protuberances, blossoms, brings crops and seeds in the end of autumn and arrival of frosts, it dies. Annual flowers are also called seasonal or summer flowers. The most of annual flowers originates from the Mediterranean (*Verbena, erinoides*), South Africa (*Lobelia erinus*) and various parts of the North and South America (*Begonia semperflorens, Salvia splendens, Ageratum houstonianum*). Annual flowers blossom during the summer and the most of these flowers are blooming a few weeks after sowing. They are characterized by ornamental blossoms of various colours and interesting shapes, and some of them have pleasant smell. They like the sun, in the shadow they cannot achieve their full beauty. Rain also decreases the beauty of the annual flowers, especially of sorts which originate from warm, sunny areas. Annual flowers have mainly modest requirements as they thrive on free, airy and sunny places. Only some sorts can endure slight shadow i. e. *Begonia semperflorens, Tagetes patula, Ageratum houstonianum*, and in the next stages of growth *Calendula officinalis, Petunia hybrida, Zinnia elegans*. Species that originate from the Mediterranean can bear -2 do -3 °C, while annuals from America do not endure the frost. Moisture is necessary for prolonged flowering, so annuals must be watered. Considering the soil, there are no big requirements, can't stand well with fresh, stable manure because of too quick growth, and they are susceptible to attack of diseases and pests. Annuals are seed planted i. e. generatively, and by cuttings, that is vegetatively. Vegetative annuals are propagated by green cuttings which are taken from the parent plant. As the parental plant, the selection is made from the items with the best properties, for instance: resistance to weather circumstances and diseases, early blooming, intensive colour of the blossom and blossom endurance (Dudaš et al, 2012). Propagating of plants by taking spring cuttings is done during the winter. Sowing period is different and it depends on species, vegetation length, time of sowing and location (Dudaš, 2005). According to the time of sowing, annual flowers are divided into the three groups: (1) The first group includes species which are sown in the protective area in January, February or at the end of December (*Begonia semperflorens, Salvia splendens, Ageratum houstonianum, Impatiens wallerana*). ; (2) The second group includes the species which are sown in the protected area in March and April (*Tagetes patula, Zinnia elegans*). ; and (3) The third group is sown in the open space from the end of March to the end of May. Due to the market demands, annuals from the second and third group are very often sown earlier than in the mentioned periods but inside protected areas. In the modern production of flowers, efforts are made to reduce vegetation period of some species and cultivars, so that production expenses could be decreased and to bring plants into the blooming stage in the shortest possible time. The aim of these researches refers to determination of optimal planting terms for annual flowers in two climatic regions. Earlier blooming increases profitability and better sale on the market. That's why, the question of importance is raised for connecting the production between Mediterranean and continental parts of Croatia, so the flowers from local production would become more competitive on the domestic market. . Sale of the flowers on the local markets, door-steps and local events would be replaced by the sale via bigger chain stores, what would give advantage to the flowers from local production in relation to those from the import. Annuals are used for sowing in gardens, parks and public places, rocky areas and as ornaments on the graves. They are seeded in the pots for balconies, windows and can be used for walls coverage.

2 Datasets and Methods

2.1 Varieties of annuals

The research includes six varieties of annuals, which are often grown both in the continental and Mediterranean regions of Croatia: *Begonia semperflorens, Salvia splendens, Ageratum houstonianum, Impatiens wallerana, Tagetes patula* and *Zinnia elegans*.

Begonia semperflorens: It originates from Brazil. It can grow up to 15 – 30 cm in height and it blossoms from April up to appearance of frosts and cold weather. It is sown at distance of 20 cm on sunny and semi-shaded places from April to June. It can be grown in the window boxes and balconies or as a pot-flower. It requires fertile soil. It can endure hot and dry weather, but in spite of that it should be regularly watered and nourished to blossom. It is propagated by very tiny seeds. In 1 g of seeds, there are 50 000 seed grains. It is sown in January or February in protected space, in containers with substratum. *Begonia semperflorens* could be propagated by vegetative green cuttings too.

Salvia splendens: It originated from Brazil where is grown as perennial. Shrubby in growth, a stalk is quadrangular. Flowers make peak blossom, and on each knee there are 2 to 6 flowers in the groups. *Salvia splendens* grows on sunny and warm place with moderate moisture. Soil must not be too rich because smaller number of flowers will be developed with more leaves. It is used for cultivation of flower beds on greater public areas, where is specially effective. It is propagated by seeds and cuttings. Seeds are sown in January and February in containers inside the greenhouses.

Ageratum houstonianum: It originates from Mexico and Peru. It grows up to 20 - 30 cm in height. Massive in growth, a stalk is covered by thick hairs, it is very branched out, and twigs extended horizontally. Blossom is in the shape of flakes, usually blue, but could be pink or white. It flowers from the end of Spring to the first frosts when the plant dies. It is sown at distance of 20 - 30 cm, so beautiful spacious blooming carpets can be created. It likes sunny and semi-shaded places, loose soil and regular watering. If decayed flowers are cut, blooming is prolonged. It is propagated by seeds or cuttings.

Impatiens wallerana: It originates from Africa and Asia where it grows as perennial. There are few annuals which like shades, that's why this plant is most often ornament of shaded garden during summer. It grows up to 20 - 30 cm in height. Flowers range in various colours from white, pinky-redish, to blue. *Impatiens wallerana* likes wet, shaded soil rich with humus. It is sensitive to lack of moisture, so its shortage can cause shred of leaves and buds. Except for decoration of garden beds and beds of public areas, *Impatiens wallerana* is used as a plant for window boxes. It propagates by seeds. It is sown at the end of February or beginning of March, so it could grow up for cultivation in the open spaces, when danger of late, spring frosts passes away.

Tagetes patula: It originates from Mexico. It grows up to 30 - 60 cm in height, it is tall and widely branched. On the end of flowering stem there is a flower of golden yellow or brown-red colour. It blooms from June to October. The whole plant has intensive and a little crude scent. It is very resistant plant. It can be cultivated in any soil and can suffer drought quite well, but it prefers sunny places. It is propagated by seeds at the end of March and in April. For early flowering, cultivation can be done in January too.

Zinnia elegans: It originates from Mexico. A stalk is fragile, covered by hairs and is widely branched. It grows up to 30 - 100 cm in height (dwarf, medium or tall *Zinnia*). Leaves are fronting each other, rough, elongated, roundish on the ends. On the top of flowering stem, a flower is developed of diameter 10 -15 cm. A flower can be semi-full or full. *Zinnia elegans* grows on sunny, warm and protected position. For a successful growth, it is necessary to provide rich soil and rather big quantity of water. It is propagated exclusively by seeds.

2.2 Substratum for cultivation

Selection of the substrates is a key factor in the cultivation of flowers. When growing seedlings and young plants, commercial substrates are used. After that, when sowing the flowers in the gardens, it is very important to provide necessary nourishment by the garden's soil, but on the other hand, economic, ecological and energetic factors should be also taken into the account. In the modern agricultural practice, endeavours are made to preserve the environment from the excessive fertilization by nitric fertilizers. That's why, it is very important to stimulate

microbiological activity in the soil, especially in the direction of biological fixation of nitrogen which would enrich the garden's soil in the natural way (Pohajda 2011, 2012). In that research cultivation of annuals in continental and Mediterranean regions of Croatia, Klasmann substratum was used for sowing the flowers. KTS 1 was used for sowing and KTS 2 after picking. Klasmann substratum is a mixture of slightly broken down white and black peat. It contains an admixture for easier absorption of water, and a complex manure with microelements was added (NPK 14: 16: 18).

2.3 Means for protection of plants

For protection from diseases, preventive treatment was performed by a fungicide Previcur 607 SL. It is systemic fungicide for prevention of the most common plant diseases powdery mildew and grey mildew. Insecticide *Confidor* SL 200 was used for protection from pests.

2.4 Production area

On the family farms in the continental and Mediterranean Croatia, where researches were done, production of flowers had been done in protected areas-greenhouses. A greenhouse's sides were made of hard foil, and the roof is consisted from double foil with possibility to let inside warm air. Material of manufactured artefact is polycarbonate. Ventilation of a greenhouse is possible by roof, side and frontal openings. Heating in the greenhouse is solved by thermogen stoves on heating oil. Each greenhouse has its own stove and thermostat which regulates temperature in the space. Stoves let the warm air into the greenhouse, and for an hour about 4000 m³ air is mixed. Irrigation in the greenhouses is performed by the system of microsprays. Microsprays are placed on the roof construction of a greenhouse, because production material is put on the tables which are movable in two directions.

2.5 Geographical areas of the research

Research on cultivation of annuals was made on the family agricultural estates. In the Mediterranean region of Croatia researches were made in the Istrian county in Rovinj, and in the continental part of Croatia, the Zagreb county was chosen and the town Velika Gorica. The climate in Istria considerably varies, depending on micro locations. As it is a peninsula, surrounded by the sea on three sides, four types of climate can be found. Research was performed in Rovinj which is situated in the west coast of Istria. There is a mediterranean climate characterized by moderately warm, humid climate with hot summer. The Zagreb county is located in the continental part of Croatia, which belongs to the central european continental climatic belt. Cold winter, warm summer and moderate quantity of rainfall are the basic points of the central european continental belt. In the table 1, for the purpose of comparison, min, max and average temperatures are shown according to months in seasons when researches were done.

Table 1: The mount temperatures for 4 years on two meteorological stations.

| t°C | Airport, Velika Gorica | | | | | | Rovinj | | | | | |
|--------------|------------------------|-------|------|------|-----|-------|--------|------|------|------|-----|------|
| 2009 | I | II | III | IV | ... | XII | I | II | III | IV | ... | XII |
| Min. | -17.4 | -7.0 | -4.3 | 4.2 | | -21.0 | -6.2 | -4.8 | -0.2 | 5.9 | | -9.4 |
| Max. | 14.6 | 17.5 | 19.1 | 25.3 | | 19.5 | 13.5 | 14.9 | 16.8 | 25.0 | | 16.7 |
| Aver. | -1.6 | 2.7 | 7.1 | 14.4 | | 2.2 | 5.6 | 5.6 | 8.8 | 13.9 | | 6.6 |
| 2010 | I | II | III | IV | | XII | I | II | III | IV | | XII |
| Min. | -12.5 | -11.9 | -6.7 | 0.5 | | -16.1 | -3.5 | -3.2 | -4.5 | 3.4 | | -6.1 |
| Max. | 8.9 | 16.8 | 22.2 | 27.9 | | 15.2 | 12.1 | 13.3 | 16.9 | 22.7 | | 15.6 |
| Aver. | -0.9 | 1.5 | 6.4 | 12.0 | | -1.0 | 4.1 | 6.0 | 7.6 | 12.5 | | 5.2 |
| 2011 | I | II | III | IV | | XII | I | II | III | IV | | XII |
| Min. | -7.5 | -9.9 | -8.7 | 2.0 | | -6.5 | -3.6 | -4.0 | -3.3 | 2.9 | | -1.5 |
| Max. | 15.6 | 17.4 | 23.5 | 26.5 | | 17.3 | 14.4 | 13.7 | 17.7 | 25.0 | | 17.4 |
| Aver. | 1.6 | 0.9 | 6.9 | 13.2 | | 3.2 | 5.1 | 5.6 | 8.4 | 13.4 | | 8.3 |

| | | | | | | | | | | | | |
|----------------|----------|-----------|------------|-----------|--|------------|----------|-----------|------------|-----------|--|------------|
| 2012 | I | II | III | IV | | XII | I | II | III | IV | | XII |
| Min. | -9.8 | -21.5 | -4.6 | -3.3 | | -16.7 | -3.2 | -9.1 | -0.5 | 0.6 | | -2.4 |
| Max. | 13.5 | 17.7 | 23.8 | 30.2 | | 14.5 | 13.2 | 14.8 | 20.1 | 24.9 | | 14.5 |
| Aver. | 1.8 | -2.5 | 9.2 | 12.2 | | 0.8 | 5.0 | 2.1 | 9.9 | 12.6 | | 6.2 |
| 4 years | I | II | III | IV | | XII | I | II | III | IV | | XII |
| Min. | -17.4 | -21.5 | -8.7 | -3.3 | | -21.0 | -6.2 | -9.1 | -4.5 | 0.6 | | -9.4 |
| Max. | 15.6 | 17.7 | 23.8 | 30.2 | | 19.5 | 14.4 | 14.9 | 20.1 | 25.0 | | 17.4 |
| Aver. | 0.2 | 0.7 | 7.4 | 13.0 | | 1.3 | 5.0 | 4.8 | 8.7 | 13.1 | | 6.6 |

3 Results and discussion

3.1 Results on cultivation of annuals in the Mediterranean Croatia

Begonia semperflorens, Impatiens wallerana, Zinnia elegans

These species of annuals (Table 2) were not seeded, but their seedlings were ordered from the manufacturer. Reason for that was in inadequate amount of production area which is used for production of vegetables in that period. Seedlings were placed in the greenhouse at the end of February, into the containers made of styrofoam with 448 holes. Species *Begonia semperflorens*, *Impatiens wallerana* and *Zinnia elegans* were cared for till the picking, at daily temperatures of about 26° C, at night about 18 °C. Relative humidity ranged about 80%. Spraying was done a few times per a day by the system of microsprays. Rain-water was used for irrigation. Manuring was not performed because the quantity of manure in the substratum satisfied plant's needs. Picking was done after three weeks from buying the seedlings, and that was the time when the third, real leaf was developed in the fourth week of February 2009. Plants were carefully taken out by wooden and metal sticks, so the roots would not be damaged. Picking of the plants was done in containers made of styrofoam with 150 holes. In this stage another substratum TKS 2 was used, with more rough structure and with increased content of manure. Daily temperatures in the greenhouse ranged from 20-22 °C, at night 16-18 °C. Relative humidity ranged about 80%. Spraying was done twice a day, in the morning and in the evening. Manuring in this stage was not done neither, because the substratum TKS 2 also had enough nourishment for the period up to second picking. Planting out was performed 2-3 weeks after the picking in the first week of April 2009. Planting out is usually done when the plants start to touch themselves mutually. Picking of plants was done in the pots and containers for four plants, dimensions 52x52 mm. In this stage, the same substratum was used as the one after the first picking, of more rough structure and increased content of manure in relation to the substratum used for sowing. The greenhouse was not additionally warmed, but it was heated by the sun rays. This stage was performed in the middle of April 2009, the greenhouse was ventilated during a day, mainly to accustom the plants to open space, besides, ventilation decreases temperature and relative humidity in the greenhouse. Irrigation was very short, twice a day. Excessive moisturing was avoided, especially of a leaf mass, to decrease the possibility of getting a disease. Manuring was not done neither, as in the first two stages, the substratum provided enough nourishment because produced annuals were quickly moved to open cultivation (Vaci 2010.).

Salvija splendens, Ageratum houstonianum, Tagetes patula

These species of annuals (Table 2) were seeded by machines into the containers with 448 holes made of styrofoam. *Tagetes patula* was manually seeded due to the specific shape of seeds . For the sowing of low *Tagetes patula* containers were mechanically filled, then holes were made by special tools and seeds were manually placed. Sowing was done in the fourth week in February 2009. The substratum TKS 1 was used, which is intended for sowing of flowers and has fine structure. Seeds of *Salvia splendens* and *Tagetes patula* were covered by the vermiculite for better moist preservation. Seeds of the species *Ageratum houstonianum* are not covered by vermiculite, because light is necessary for germination (Čoga et. al, 2005). Temperature in the chamber is adjusted to 26 °C, relative humidity of air 70 - 80%. *Salvia splendens* and *Tagetes patula* were 48 hours in the chamber, and *Ageratum houstonianum* 60 hours, that's time necessary for germination of seeds. *Ageratum houstonianum*, *Salvia splendens* and *Tagetes patula* , till

their picking, were cared for at daily temperatures of about 26°C, at night about 18°C. Relative humidity of air ranged about 80%. Spraying was done a few times per a day by the system of microsprays. Manuring was not performed because quantity of manure in the substratum was enough. Picking was performed after three weeks, in that time the third real leaf was developed. Picking of plants was done into the containers made of styrofoam with 150 holes. In this stage, another substratum was used TKS 2. Daily temperatures in the greenhouse ranged between 20 - 22 °. C, at night 16 - 18 °C. Relative humidity of air ranged about 80%. Spraying was done twice a day, in the morning and in the evening. Manuring in this stage hadn't been done. Planting out was done in the pots and containers for four plants, size 52x52mm. The substratum TKS 2 was used in this stage. Additional warming up was gradually decreased to stop. So in the end the greenhouse was naturally heated by the sun. This stage was done in the middle of April, during a day, the greenhouse was ventilated to accustom produced plants to open space. Ventilation also decreased temperature and relative humidity in the greenhouse. Irrigation was short, twice a day. Excessive moisturing was avoided, especially of a leaf mass to decrease the possibility of disease. Manuring was not done, in the first two stages neither (Vaci, 2010).

Table 2: Annual flowers in Mediterranean Croatia (end of production is for all: II week in April).

| Flower | <i>Begonia semperflorens</i> | <i>Impatiens wallerana</i> | <i>Zinnia elegans</i> |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Calendar year | 2009 | 2009 | 2009 |
| Buying seedlings | IV week in February | IV week in February | IV week in February |
| Picking | III week in March | III week in March | III week in March |
| Planting | I week in April | I week in April | I week in April |
| Nursure measures | t° 18-26°C and 16-22°C April = without heating Relative humidity of air about 80 % Watering 2x a day Without nourishment | t° 18-26°C and 16-22°C April = without heating Relative humidity of air about 80 % Watering 2x a day Without nourishment | t° 18-26°C and 16-22°C April = without heating Relative humidity of air about 80 % Watering 2x a day Without nourishment |
| Flower | <i>Salvija splendens</i> | <i>Ageratum houstonianum</i> | <i>Tagetes patula</i> |
| Calendar year | 2009 | 2009 | 2009 |
| Sowing | III week in February | III week in February | III week in February |
| Picking | II week in March | II week in March | II week in March |
| Planting | I week in April | I week in April | I week in April |
| Nursure measures | t° 18-26°C and 16-22°C April = without heating Relative humidity of air about 80 % Watering 2x a day Without nourishment | t° 18-26°C and 16-22°C April = without heating Relative humidity of air about 80 % Watering 2x a day Without nourishment | t° 18-26°C and 16-22°C April = without heating Relative humidity of air about 80 % Watering 2x a day Without nourishment |

3.2 Cultivation of annuals in the continental Croatia

Begonia semperflorens, Impatiens wallerana, Zinnia elegans

These species of annuals (Table 3) were sown by seeds in the fourth week of December 2010. Species of *Begonia semperflorens* and *Impatiens wallerana* were cared for at daily temperatures of about 21°C. After three weeks, small, young plants germinated. Relative air humidity was about 80%. Picking was done in the third and fourth week in January 2011. Daily temperatures in the greenhouse ranged from 18 C to 20 °C. Relative humidity of air was about 80%. Spraying was performed twice a day, in the morning and in the evening. Planting out was done in the second and third week in February 2011. Irrigation was performed on the submersible tables. The greenhouse was warmed up to achieve temperature of 18 to 20 °C. Nourishment was done

by Peters-starter formulation 10: 52: 10 after planting out, twice every two weeks. In March, manure for development of green mass was used, of the same manufacturer, formulation was 30: 10: 10 four times, each week. However, once in April 2011, manure 16: 18: 36 was used with addition of MgO. Protection of plants was performed twice a week together with irrigation. The same substrates were used as for cultivation in the Mediterranean part of Croatia.

Salvija splendens, Ageratum houstonianum, Tagetes patula

These species of annuals (Table 3) were sown in the fifth week of December 2011. Seeds of *Salvia splendens* and *Tagetes patula* were covered by vermiculite for better moist preservation. Temperature of 22 °C was maintained. Relative humidity of air ranged about 80%. Watering was done on daily level, by the system of microsprays. Picking of the species *Salvija splendens* and *Ageratum houstonianum* was performed after three weeks in the third week of January 2011, and seedlings of species *Tagetes patula* were immediately planted out. Reason for that is in the fact that seedlings of species *Salvia splendens* and *Ageratum houstonianum* are more sensitive in comparison to species *Tagetes patula*. During initial, slower growth, and after germination, they require abundant watering which washes out nourishments. Tap water in the Zagreb county is hard, so that makes another negative factor. In that way, watering can cause alkalinity of the substratum, what makes the young plants to turn yellow. Due to these reasons, taking an aim to stimulate further growth, picking of the young plants is necessary (Pohajda and Žutić 2012). The plants were picked into containers, into the substratum TKS 2. Temperatures in the greenhouse were 18°C. Relative humidity of air ranged about 80%. Spraying was done on daily base. Seeding of the species *Salvia splendens* and *Ageratum houstonianum* was performed 3 - 4 weeks after picking into the substratum TKS 2. Fertilization was the same as for the species *Begonia semperflorens*, *Impatiens wallerana* and *Zinnia elegans* and was done by the manure Peters-starter formulation 10: 52: 10 after planting out, twice, every two weeks. In March 2012, manure for development of green mass was also used, four times every week. In April 2012, manure 16: 18: 36 with addition of MgO was once used.

Table 3: Annual flowers in continental Croatia (end of production is for all: II week in April).

| Flower | <i>Begonia semperflorens</i> | <i>Impatiens wallerana</i> | <i>Zinnia elegans</i> |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Calendar year | 2010/2011 | 2010/2011 | 2010/2011 |
| Sowing | IV week in December | IV week in December | |
| Picking | IV week in January | III week in January | |
| Planting | III week in February | II week in February | II week in February |
| Nursure measures | t° 18-20°C Relative humidity of air about 80 % Watering 2x a day Fertilization manure: starter 10: 52: 10 2X, 30: 10: 10 4X, 16: 18: 36 + MgO 1X | t° 18-20°C Relative humidity of air about 80 % Watering 2x a day Fertilization manure: starter 10: 52: 10 2X, 30: 10: 10 4X, 16: 18: 36 + MgO 1X | t° 18-20°C Relative humidity of air about 80 % Watering 2x a day Fertilization manure: 30: 10: 10 4X, 16: 18: 36 + MgO 1X |
| Flower | <i>Salvija splendens</i> | <i>Ageratum houstonianum</i> | <i>Tagetes patula</i> |
| Calendar year | 2011/2012 | 2011/2012 | 2011/2012 |
| Sowing | V week in December | V week in December | V week in December |
| Picking | III week in January | III week in January | |
| Planting | III week in February | II week in February | III week in January |
| Nursure measures | t° 22°C and 18°C Relative humidity of air about 80 % Watering 2x a day | t° 22°C and 18°C Relative humidity of air about 80 % Watering 2x a day | t° 18°C Relative humidity of air about 80 % Watering 2x a day |

| | | | |
|--|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| | Fertilization manure: starter 10: 52: 10 2X, 30: 10: 10 4X, 16: 18: 36 +MgO 1X | Fertilization manure: starter 10: 52: 10 2X, 30: 10: 10 4X, 16: 18: 36 +MgO 1X | Fertilization manure: starter 10: 52: 10 2X, 30: 10: 10 4X, 16: 18: 36 +MgO 1X |
|--|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|

3.3 Statistical analysis

Table 4: Production cycle lengths for annual flowers in Mediterranean and continental Croatia.

| production cycle length | Mediterranean Croatia | continental Croatia | difference |
|--------------------------------|------------------------------|----------------------------|-------------------|
| <i>Begonia semperflorens</i> | 10 weeks | 16 weeks | 6 weeks |
| <i>Impatiens wallerana</i> | 10 weeks | 16 weeks | 6 weeks |
| <i>Zinnia elegans</i> | 11 weeks | 17 weeks | 6 weeks |
| <i>Salvija splendens</i> | 9 weeks | 15 weeks | 6 weeks |
| <i>Ageratum houstonianum</i> | 9 weeks | 15 weeks | 6 weeks |
| <i>Tagetes patula</i> | 9 weeks | 15 weeks | 6 weeks |
| average | 9 weeks and 5 days | 15 weeks and 5 days | 6 weeks |

As shown in Table 4, for all annual flowers from this study, the production cycle length in Mediterranean Croatia is approximately for 6 weeks shorter than in continental Croatia. The main reason is more sunny days in Mediterranean Croatia, what results in a higher level of average temperatures (Table 1).

4 Conclusions

In the flower production on the family farming estates greater number of flower species has been produced, what is an obstacle for achieving quality and quantity of this production. Making orientation for producing less species, requirements will be satisfied which increase commercial value of the plant as they are: colour of a flower, duration of blossom, time of blooming, plants' uniformity, plants' resistance to diseases and pests and mechanical stresses. Besides, in modern flower production, there is an intention to decrease vegetative period of some species and cultivars so the production expenses could be decreased and to bring plants into the stage of blooming in the shortest possible time. Earlier blooming increases profitability and better position is provided on the market. According to the results taken after considering cultivation of flowers in the Mediterranean and continental parts of Croatia, it can be noticed that temperature is restricting factor in the production process. Although technological terms were complied with in these two regions, it has been determined that continental Croatia requires higher investments into production of annual flowers due to needs for investing into bigger quantity of energy. Supporting these facts, average temperatures for mentioned areas covered by the research, are shown. Temperature of the protected area in the continental Croatia was, on an average, lower for 2 °C, with rather higher energy consumption in reference to the Mediterranean Croatia. In the production of flowers in the Mediterranean part, plants were not additionally fed although they were cultivated in the same substratum as in the continental Croatia. Also, cultivation period for the varieties for all annual flowers from this study was shorter, more than 1,5 month in relation to cultivation of the same varieties in the continental region. Therefore, aiming to improve agricultural production and competitiveness on the market, production of the annual flowers in Croatia would improve by specialization of manufacturers for less species of flowers, cultivation of flowers in the Mediterranean part during the winter and shifting from earlier to later production terms in cultivation of flowers in the continental part of Croatia.

Bibliography

Čoga, L., Herak – Ćustić, M., Ćosić, T., Vršek, I., Pavlović, I., Jurkić, V., Poljak, M., Potočić, L., Petek, M., *Uloga pripreme supstrata u rasadničarskoj proizvodnji*. Zagreb: Agronomski glasnik, glasilo Hrvatskog agronomskog društva. 2005. vol. 67, pp. 2-4.

- Dudaš, S. *Untersuchung zu Einflussfaktoren auf ätherische Öle in Thymian (Thymus vulgaris L.)*. Dissertation. Berlin: Logos, 2005, ISBN 3-8325-0952-6, p. 196 (disertacija).
- Dudaš, S., Makovac M., Varga, S., *Ispitivanje ukorjenjivanja reznica pelargonija Pelargoniu peltatum 'Temprano Narina' i 'Corriente Beach' u različitim terminima i na različitim supstratima*. Biotechnical centre Naklo, Slovenia: Proceedings 1st International Scientific Conference, Conference on Agriculture, Environmentalism and Horticulture. »Transmission of Innovations, Knowledge and Practical Experience into Everyday Practice«. 2012. 14 pp. 1-8.
- Pohajda, I. *Cvjećarstvo sjeverozapadne Hrvatske*. Šibenik. Međunarodno interdisciplinarno savjetovanje-Njega gradskoga prostora; Urbano zelenilo od planiranja do rasadnika. 2007.
- Pohajda, I. *Simbiozna učinkovitost autohtonih sojeva Rhizobium spp. izoliranih iz tala Zagrebačke županije*. Disertacija. Zagreb: Agronomski fakultet . 2011, pp. 96-100.
- Pohajda, I. *Practical application of symbiotic nitrogen fixation as a way of preservation and protection of agricultural soil*, Zenica: Proceedings 2nd International Symposium on Environmental and Material Flow Management. 2012. pp. 97-102.
- Pohajda I., Žutić I., *Arnika (brđanka i američka arnika)*. Zagreb: Poljoprivredna savjetodavna služba 2012. ISBN- 978-953-6763-31-3. pp. 7-9.
- Vaci, D. *Tehnologija uzgoja jednogodišnjeg cvijeća u rasadniku Longo*. Diplomski rad. Poreč: Veleučilište u Rijeci, Studij mediteranske poljoprivrede u Poreču. 2010.