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THESIS SUMMARY

RESEARCH REGARDING THE INFLUENCE OF SOME AGROTECHNOLOGICAL MEASURES UPON BROCCOLI PRODUCTION IN ORDER TO INCREASE ECONOMIC EFFICIENCY

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Brassica oleracea, convar. botrytis, var. Italica, Fam. Brassicaceae (Cruciferous) is grown for its dark green inflorescences. Its English name, derives from the Italian "brocco" and the Latin "brachium" meaning arm or branch (BOSWELL, quoted by Singh et al., 2004).

According to the latest researches, the first ten most nutritionally important vegetables are: 1 broccoli, 2 spinach, 3 Brussels sprouts, 4 beans, 5 peas, 6 asparagus, 7 artichoke, 8 - cauliflower, 9 sweet potato (beater), 10-carrot (www.the-perfectshape.com / category / vegetables /).

Broccoli is a vegetable known for its qualities of cancer prevention, by regular consumption it can help to strengthen the immune system, slow the aging process.

In the era of antibiotics, hormones, the corticoids and other synthetic products may seem strange that humanity tends to return to natural therapies, by using herbs, fruits, vegetables or cereals (VALNET, 1987).

Broccoli and broccoli sprouts contain a phytochemical compound called sulforaphane, that kills bacteria Helicobacter pylori. This bacteria is guilty of most ulcers and stomach cancer. Tests proved that sulforaphane can destroy the bacteria that is resistant to other antibiotics. Sulfur substances and vitamins that broccoli contains, have an important role in stopping the chaotic multiplication of cancer cells, in helping to prevent and even cure some types of cancer, such as: esophagus, larynx, stomach, prostate, colon and lung cancer.

It is recommended to eat broccoli raw or as juice in high quantities, especially since the phytonutrients in cruciferous vegetables are very good protectors of soft tissue.

Broccoli is grown all over the world, except the humid tropical areas. China is the largest producer of cauliflower and broccoli, in the world, with 8.5 million tons. On the second place is India, with 6.5 million tons.

Although the overall trend remains on the cultivation of a range of traditional vegetables, in recent years began a diversification, the trend is due to both imports, the appearance of certain consumers who can afford to buy vegetables that are more expensive, but also the presence of foreigners who are working in Romania and have specific preferences, for example, Chinese cabbage, Brussels sprouts, lettuce, kale, broccoli, asparagus and others.
Although at first this assortment was mainly imported, a number of local producers began to cultivate this species and sell them to major retail chains or sell them on the open market, with reasonable prices (STEFAN, et al., 2008).

In Romania, the high demand for broccoli by the big chain stores, creates an opportunity for local farmers to cultivate this species, especially that supermarkets import broccoli. Culture of broccoli is sporadic, probably because only in recent years, Romanians have discovered it in hypermarkets and become more informed about it.

Broccoli culture is not very demanding of vegetation factors and everyone can have this wonderful vegetable in its own garden, with a minimum of effort, resembling, in terms of breeding, to cabbage and cauliflower.

**The main aim of the experimental research** in the years 2010 - 2012 was to establish agrotechnological measures that would increase the production efficiency of broccoli. The behavior, in culture, of broccoli hybrids was followed, also optimum culture epoch and the possibility of obtaining crops through direct seeding or with seedlings, in the natural conditions of Regin region – Mures county.

**The research objectives** were to determine the behavior of some hybrids (Caesar, Calabrese Natalino, Ramoso Calabrese and Green Calabrese) in culture; the influence of the culture method and culture epoch upon broccoli plant growth (height of the plant, leaf rosette diameter, number leaves per plant, inflorescence size, weight of the inflorescences); establishing the influence of the starting epoch and method of culture on the production of broccoli; the influence of studied factors upon crop efficiency.

Experimental cultures were held in 2010-2012, on the experimental lot at the Agricultural Lyceum "Ion Bojor" in the town Regin, Mures County. The climatic conditions in Transylvania and Regin area, are favorable for growing broccoli, especially during spring and autumn when temperatures moderate values are favorable for the formation of quality inflorescences.

**EXPERIENCE I – THE INFLUENCE OF CULTURE METHOD AND CULTURE EPOCH UPON BROCCOLI YIELDS.**

In 2010 and 2011 the aim of the experience was to establish optimal culture epoch and the possibility of achieving broccoli crops by direct seeding compared to those obtained with seedlings.
In the experience, Natalino Calabrese hybrid was used, an early variety with a vegetation period of 60-70 days after transplanting and inflorescences with an average weight of 300-400 g.

Experimental factors were: method of culture (by seedling and direct seeding) and establishing the starting epoch (April, May and June). The combination of the experimental factors resulted in six experimental variants, that were placed in three repetitions. During the vegetation period, the specific technology for field broccoli was applied and observations were conducted that were established in the experimental protocol.

On average, over a two-year period (2010-2011), in the first epoch of culture, the production was 29.57 t/ha compared to 18.02 t/ha, in epoch III. Production growth recorded in epoch I of culture was of 26.0% and the output gap was distinctive significant.

Comparing the two methods it can be observed that the direct sowing method of production obtained a yield of 26.56 t/ha as compared to 20.85 t/ha when the culture was started with seedlings, the difference in production was very significant.

The analysis of the combined influence of the method and the epoch of setting broccoli crop, a favorable effect on production was observed at the direct seeding method in the three epoch of culture. Thus the epoch I of direct seeding cultivation method provides a production increase of 33% and a very significant output gap. In epoch II, the crop started by direct seeding method provides a yield of 25.27 t/ha compared to 21.50 t/ha at the seedling method. Production growth was 18% and the difference of production was distinctive significant. In epoch III, yields were lower, but also, in this epoch, at the direct seeding method, production was higher, of 20.53 t/ha, compared to the production obtained at the seedling method, of 15.50 t/ha, with a distinctive significant difference.

The analysis of the average results regarding the interaction of factors, epoch when the culture was started and the culture method used, it was found that the production of broccoli, was higher in the first epoch of culture, at the method of direct seeding, being of 33.72 t/ha with 33% higher than that achieved in epoch II. When the culture was started with seedlings, the first epoch showed a production increase of 18% compared to that achieved in epoch II.
EXPERIENCE II. BEHAVIOUR OF AN ASSORTMENT OF BROCCOLI HYBRIDS IN A CULTURE STARTED BY DIRECT SEEDING.

In 2012, studies concentrated on the behavior of broccoli hybrids in crops started by direct seeding. Objectives were to determine plant growth (plant height, rosette diameter, inflorescence size) and obtained production.

In the experiences the following hybrids were used: Cezar, Calabrese Natalino, Ramoso Calabrese and Green Calabrese which were grown by direct sowing in the field. Planting epochs were May (05.05.2012) June (09/05/2012) and July (13.07.2012). From the combination of the experimental factors, 12 experimental variants resulted, that were located in three repetitions. Plant emergence was recorded in 10 of May, 14 of June and 13 of July 2012. Harvesting of the main inflorescence was done in the first decade of September, for the first sowing epoch, in the first decade of October for the second sowing epoch and in the first decade of November for the third sowing epoch. During the growing season the specific technology was applied for open field broccoli crops observations were conducted.

Broccoli plant growth was influenced by the sowing epoch of the crop, due to plants growing in different conditions of temperature and differed at each cultivar. After 30 days from emergence, the height of the plants from epoch I, was between 5.6 cm at hybrid Calabrese Ramoso and 10.3 cm at Caesar. Plants sown in epoch II were between 5.1 cm at hybrid Calabrese Ramoso and 8.7 cm at Cezar and in epoch III, broccoli plants had a height between 4.2 cm at Ramoso Calabrese and 9.3 cm at Green Calabrese. After 60 days from emergence, broccoli plants had height between 17.2 cm (Ramoso Calabrese, epoch III) and 32.2 cm (Cezar, epoch I). After 90 days, the plants have reached a height between 30.6 cm (Calabrese Natalino, epoch III) and 57.4 cm (Ramoso Calabrese, epoch I). During the 90 days, daily growth was between 0.34 cm / day at hybrid Ramoso Calabrese sowed in epoch III and 0.64 cm / day at Ramoso Calabrese sowed in epoch I.

After 30 days from emergence, the number of leaves / plant in epoch I, was between 4.4 at hybrids Ramoso Calabrese and Cezar and 5.9 at Green Calabrese. The number of leaves from the plants sown in epoch II were between 2.9 leaves / plant at
Calabrese Napolitano and 3.6 leaves/plant at Caesar and number of leaves from the plants sown in epoch III were between 2.5 at Cezar and 4.2 cm at Ramoso Calabrese.

After 60 days from emergence, broccoli plants had a leaf number between 5.2 (Calabrese Napolitano, epoch II) and 14.0 (Green Calabrese, epoch I). After 90 days the plants were growing between 13.6 leaves/plant (Calabrese Natalino, epoch II) and 20.5 (Ramoso Calabrese, epoch I).

During the 90 days, daily increase in the number of leaves/plant ranged from 0.15 at hybrid Calabrese Natalino, epoch II and 0.23 at Calabrese Ramoso in epoch I.

After 60 days from emergence plants had a rosette of leaves between 23.3 cm (Green Calabrese, epoch II) and 57.3 cm (Green Calabrese, epoch I). After 90 days the plants rosette diameter was between 47.6 cm (Green Calabrese, epoch II) and 81.0 cm (Ramoso Calabrese, epoch II). During the 90 days the daily growth of the rosette diameter was between 0.52 cm at Green Calabrese hybrid, sown in epoch II and 0.90 cm at Ramoso Calabrese, sown in epoch I.

Different growth at broccoli plants, in the three sowing epochs, influenced production for the four hybrids. The average production of broccoli was between 15.35 t/ha, in epoch III and 23.80 t/ha in epoch I. Production obtained in epoch III was lower by 8.45 t/ha compared to that achieved in epoch I.

Broccoli production ranged from 16.00 t/ha at hybrid Green Calabrese and 25.85 t/ha at hybrid Cezar. Compared to hybrid Ramoso Calabrese, hybrid Cezar, had a production increase of 22.0%, compared to the control the output gap is very significant.

In general, broccoli hybrids studied had lower yields when sowing was done in epoch III (July). Maximum yields were obtained at the plants from sowing epoch I.

INFLUENCE OF CULTURE METHOD AND EPOCH OF SOWING OF BROCCOLI CROPS UPON ECONOMIC EFFICIENCY.

From the analysis of the economic situation, at the broccoli crop, it was found that both the direct costs and the cost of production per kg were larger when the crop was started with seedlings, although their yields were lower compared to the direct seeding method, where yields were higher;

Highest income was recorded at the direct sowing method, in April, of 168,600 lei compared to 77,500 lei, at the seedling method, established in June;
Highest profit per kilogram was recorded also at the variant planted by direct seeding, established in April, a profit of 3.89 lei / kg, at a retail price of 5 lei / kg, followed by the other variants also started by direct sowing;

Highest profit per hectare was recorded at the version cultivated by direct seeding in April, of 131.206 lei / ha, followed by the direct seeding option, started in May;

At the method started with seedlings, planted in April, profit per hectare was of 32.633 lei / ha followed by the variant planted in May, with 13,623 lei/ha.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research, carried out in the three years, at broccoli crop, in conditions from Reghin, in different epochs, by direct seeding or planting seedlings in the field, the following conclusions resulted:

• in what regards the culture technology, it has been observed that the method of direct sowing in the field ensures higher production values, compared to the method of production with seedlings, due to a better supply of water from the soil, in all epochs of culture.

• production was higher, when the crop establishment was conducted in April by direct seeding, followed by the variants established in May, with seedlings, as in this way, high summer temperatures, have been avoided during the formation of inflorescences.

• compared to the average of the four cultivars, the highest production was achieved by hybrid Cezar with 25.87 t / ha and the lowest yield was recorded at hybrid Green Calabrese.

Following the results obtained in experimental crops of broccoli started with seedlings or by direct sowing, in different culture epochs, using several hybrids the following recommendations can be made:

- Reghin vegetable zone, in pedoclimatic terms, ensures favorable conditions for the cultivation of broccoli;

- Broccoli crop can be started by direct seeding in the field, in April and May, in order to achieve cost-effective productions;
- For the Reghin vegetable area, cultivation by direct seeding of hybrids Cezarr and Calabrese Natalino is recommended, in order to ensure economically profitable productions.