STUDY OF AUTUMN CABBAGE CULTIVARS GROWN IN SPECIFIC CONDITIONS OF TRANSYLVANIA PLATEAU

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Abstract: Cultivar is an essential factor in vegetable production and the economic and financial outcome of the culture largely depends on it. Cultivar can influence the growing period, the commercial aspect and production yield. When choosing the right cultivar, the specificities of the area where the culture is set, must be taken into account. Autumn cabbage heads are grown for use in the preparation of various dishes, to be eaten fresh or pickled, or for winter storage. Varieties and cultivars with different characteristics are chosen depending on the yield destination. Transylvania climatic conditions are favorable for cabbage cultivation in the field due to favorable precipitation regime and lower temperature levels. The area is favorable both for cabbage heads production and also for obtaining cabbage seeds, in the second year of vegetation. The experiment was conducted in 2016 in the area of Apahida-Juc, in Someş river meadow. This area is oriented towards vegetable growing. In the experiment, the following cabbage cultivars were used: Autumn Queen F1, Bucharest F1, Fieldglory F1, Gloria F1, Royal Dynasty F1, Sarmash F1.

Keywords: white cabbage, cultivars, morphological characteristics, production.

INTRODUCTION

White cabbage (*Brassica oleracea* L. Alef. Var. *Capitata* f. *alba* DC – *Brassicaceae* family) is one of the most important vegetable species cultivated in our country, as demonstrated by the large surface area that it occupies, that is 20-27% of the total area, cultivated with vegetables (Indra et al., 2012). Fresh cabbage heads contain about 92% water, 5-6% carbohydrates, 1.2-1.5% protein, 0.2% fat; mineral salts Ca-72 mg, P-60 mg, K-400 mg per 100g fresh product; vitamins (B1-0,07 mg, C-43.0 mg B2-0,05 mg, provitamin A-0.5 mg at 100 g fresh product), and vegetable fibers which help digestion. The caloric value is relatively low (36 cal/100 g) (Popescu, Roxana Zavoianu 2011, Stan, Munteanu, 2001). In addition, cabbage contains some oils with antimicrobial effects, arsenic, in very small doses that increase appetite, potassium salts, and sulfur compounds that stimulate the intestinal functions and destroys free radicals and other carcinogenic agents. Pickled cabbage contains water (90%), protein (1.2%), carbohydrate (3.3%), vitamin B1 (0.03 mg), B2 (0.02 mg), PP (0.15 mg), C (20 mg), M and K; contains Na (1300 mg), K (350 mg), Ca (51 mg), Fe (0.3 mg), P (34 mg), values are expressed per 100 g of product (Ciofu Ruxandra et al., 2003). White cabbage is a vegetable required by consumers all year round and is equally valued for the therapeutic characteristics. Being low in fat and rich in fiber is used in diets, helping to maintain calories and fat levels to a minimum (Rubotzky, Zamuguchi, 1997). Modern medicine has demonstrated scientifically that cabbage has almost miraculous effects in many diseases (Erzebeth Csock, 2009).

Cabbage is a species that fits easily in vegetable cropping and can grow in different systems and types of crops in the field and under protection. It can be grown in early spring, summer or autumn culture, in successive, double or associated crops. Growing white cabbage is relatively simple although it is set up, usually by seedlings but does not require special care works (Apahidean Maria et al., 2005, Berar et al., 2012). Regions very favorable are the river valleys in the hilly region of Transylvania, Moldavia, and in the lowlands in the

south and west of the country, especially for very eraly crops in polyethylene tunnels and early ones in the field (Indrea, Apahidean, 2012, Poșta 2008).

Cultivar, in vegetable production, is an essential factor of production, on it largely depends the financial result. Cultivar can influence the level of achieved production, the commercial aspect and harvest time. Choosing the right cultivar must take into account the specificities of the area where the culture is done.

MATERIAL AND METHOD

The experiment took place in the area pron for vegetable growing of Apahida-Juc jud. Cluj. Experience aim was to determine which of the studied cultivars give the best results in autumn crop, in Transylvanian plateau specific climatic conditions. The objectives were to determine the growth of plants (plant height, rosette diameter), total production, with the purpose of introducing in culture new cultivars adapted to the specific climatic conditions from the testing area.

Through its location, Cluj area falls in the moderate continental climate, typical of the western and north western parts of our country and is subject to predominantly western winds movement. As a result, in winter, cold polar or arctic air from the north – west blows in and in the summer warm air from the south - west of the northern Mediterranean cyclone (Morariu and Savu, 1970). As to the climate, the Transylvanian plateau, after the system W. Köppen is within the climatic province Df, characterized in boreal climate with cold and humid winters, with the temperature of the coldest month under -30°C and the warmer one above 30°C, the amount of water from precipitation is greater than that lost by evapotranspiration. The average annual temperature in the last 10 years was 9.52°C, with 1.13°C higher than the average annual temperature calculated for the period 1901-2000, which was 8.39°C.

The distribution of the average annual rainfall in the county of Cluj is characterized by an unevenness in time and space. As a general feature their growth is from the northwest to the southeast of the county, according to the altitude of the relief. Thus, in the hilly region, Somes river Plateau the average annual quantities are between 600 and 700 mm, respectively 550-650 mm in the Transylvanian Plain and it grows in the mountainous region, reaching up to 800 mm at the periphery of the mountainous framework and 1200-1400 mm in the high zone of the Apuseni Mountains.

In the experience the following cultivars were used: Autumn Queen F1, Bucharest F1, Fieldglory F1, Gloria F1, Royal Dinasty F1, Sarmash F1.

Autumn Queen F1 is a cabbage hybrid from Takii Seeds with a flat head, weighing 2 kg in average, with thin leaves and good crack resistance. The plant has a compact appearance with vigorous growth and resistance to Fusarium. It reaches maturity after 65 days from planting.

Bucharest F1 is a summer/autumn white cabbage hybrid from Seminis, specially created for the climate conditions and the requirements of the Romanian market. The vegetation period is 80-85 days after planting. The shape of the head is spherical and the average weight is 3-4 kg. It shows resistance to cracking and handling. The production is mainly intended for processing but also for fresh consumption. Bucharest F1 responds well to these desires in the sense that the leaves are thin, flexible and have a pleasant color. Resistant to Fusarium and Xathomonas. The recommended planting density is 40,000-60,000 plants/ha.

Fieldglory F1 is a white cabbage hybrid from Bejo Zaden, intended for fresh consumption and industrialization, Fieldglory F1 is a Braunswich type hybrid with rounded-headed head, weighing 2-3,5 kg, resistant to cracking. Harvest maturity takes place 77 days after transplantation, the recommended density being 35,000-45,000 plants/ha.

Gloria F1 is one of the most popular white cabbage cultivars. The vegetation period is 75-80 days. The leaf rosette is large, green-bluish, covered with pruin. The plant has a strong growth and a well developed root system. The formed head is round, compact, weighing between 2.5 and 4.5 kg in accordance with planting density and has very good crack, handling and transport resistance. Very good tolerance to heat and resistance to Fusarium. The production is intended for fresh consumption as well as for industrialization.

Royal Dinasty F1 is a summer-autumn white cabbage hybrid from Seminis, intended for fresh consumption. It reaches maturity in about 90 days after planting. Produces round and dense, very uniform, greenish-blue heads, weighing 3-5 kg. It is crack resistant and the storage capacity is very good. Resistant to Fusarium and Xanthomonas (IR). The recommended density is 40.000-50.000 plants/ha.

Sarmash F1 is a white cabbage hybrid, from Nickerson Zwaan, with heads that have thin leaves and fine internal structure. Harvesting can be done in summer or early autumn, for fresh consumption and industrialization. It reaches the harvesting phase after approximately 70 days of planting and forms heads of about 2 kg, with light green leaves. The grout is very vigorous, resists well in the summer heat and drought. It exhibits resistance to bacterial burn and tolerance to root rot.

The preparation of the soil began in autumn, when after the abolition of the pre-cultures, 40 t/ha of manure, 350 kg/ha of superphosphate and 150 kg/ha of potassium sulphate were added and incorporated into the soil through deep ploughing, 28-30 cm in depth. Until the experimental culture was established, the field was occupied by a spinach culture set up in the autumn, harvesting taking place in the spring. After harvesting the secondary crop, 300 kg/ha of Complex III fertilizer was applied, then a herbicide Stomp 330 EC was applied at a dose of 5 l/ha and the germinating bed was prepared with a seedbed combination.

Sowing was done on a stratum in the open, where sowing took place at the beginning of May and planting of seedlings took place in the last decade of June at distances of 0.75/0.30m, achieving a yield of 44.000 plants/ha. Each experimental parcel had a length of 3 m and a width of 1.5 m, resulting in an area of 4.5m². Specific works for autumn cabbage cultures were applied. The harvest of the heads took place when their size corresponded to the demand of the market, manually, by two passes, starting with the last decade of September and the first decade of October.

During plant development, observations were made regarding plant growth (plant height, leaf rosette diameter, head diameter, height of the head). The average head weight was determined at harvest and average yield/ha was established.

RESULTS AND DISCUSSION

At the time of planting cabbage seedlings had a normal development at all cultivars used in the experiment (Table 1). Thus, the plant height was between 18.5 cm at Autumn Qeeen F1, Bucharest F1, and 21.0 cm at Fieldglory F1 and Royal Dinasty F1 hybrids. The average leaf number per plant was 5.5, ranging from 5 to 6. The plant's stem thickness was between 0.35 cm and 0.50 cm.

Table 1

Observations on the development of cabbage seedlings
At the time of planting

Variant (hybrid)	Plant hight (cm)	Number of leafs	Stem thickness (cm)
Autumn Queen F_1	18.5	5.5	0.35
Bucharest F_1	18.5	5.5	0.40
Fieldglory F_1	21.0	5.5	0.50
Gloria F_1	20.5	5.5	0.45
Royal Dinasty F_1	21.0	5.5	0.50
Sarmash F_1	20.0	5.5	0.40

One month after planting, the height of the plants was on average 20.0 cm, except for the Royal Dinasty F1 hybrid at which the plants hada hight of 21.0 cm (Table 2). The number of leaves per plant was between 10.5 and 17 and stem thickness was between 0.85 cm and 1.0 cm. The length and width of the leaves varied from one cultivar to another. A better development of plants can be seen in Fieldglory F1, Bucharest F1 and Sarmash F1 hybrids.

Table 2

Obesrvations on the development of cabbage plants
One month after planting

Variant (hybrid)	Plant hight (cm)	Number of leafs	Stem thickness (cm)	Leafs lenght (cm)	Leafs width (cm)
Autumn Queen F_1	20.0	10.5	0.85	17.5	14.5
Bucharest F_1	20.0	15.5	0.85	22.0	14.5
Fieldglory F_1	20.0	17.0	1.0	25.0	17.0
Gloria F_1	20.0	11.0	1.0	17.0	13.0
Royal Dinasty F_1	21.0	13.0	0.85	18.0	15.5
Sarmash F_1	20.0	17.0	1.0	24.0	17.5

Table 3

Observations on the development of cabbage plants
At harvest

Variant (hybrid)	Plant hight (cm)			Head diameter (cm)	Plant weight (kg)	Head weight (kg)	Procent of head weight from total weight %
	Stem	Head	Total				
Autumn Queen F_1	15.0	9.0	24.0	20.0	2.6	2.0	76.9
Bucharest F_1	14.0	20.0	34.0	21.0	3.7	3.0	81.0
Fieldglory F_1	8.0	14.0	22.0	28.0	3.0	2.6	86.6
Gloria F_1	13.0	24.0	37.0	24.0	3.0	2.4	80.0
Royal Dinasty F_1	12.0	20.0	32.0	21.0	3.0	2.6	86.6
Sarmash F_1	10.0	10.0	20.0	26.0	2.5	2.0	80.0

From the data presented in Table 3, it was found that the plant height at harvest was between 20.0 cm in the Sarmash F1 hybrid and 37 cm at Gloria F1. The plant head was

denser and flattened in Sarmash F1 and Autumn Qeen F1 (9-10 cm) and higher at Gloria F1 (24 cm). Of the total plant weight, the head is between 76.9% and 86.6%.

Table 4

The influence of the cultivar on the production of cabbage

Variant	Production		Difference to culture average (t/ha)	The significance of the difference
	t/ha	%		
Autumn Queen F_1	61.4	83.3	-12.3	00
Bucharest F_1	85.6	116.1	11.9	**
Fieldglory F_1	80.3	108.9	6.6	*
Gloria F_1	74.2	100.7	0.5	-
Royal Dinasty F_1	83.4	113.2	9.7	*
Sarmash F_1	57.6	78.2	-16.1	00
Media	73.7	100.0	-	-
DL (P 5%)			5.9	
DL (P 1%)			10.5	
DL (P 0.1%)			17.4	

Cabbage heads production ranged from 57.6 t/ha at Sarmash F1 and 85.6 t/ha at Bucharest F1. Compared with experience average, the Bucharest F1 hybrid recorded a production increase of 16.1%, followed by Royal Dinasty F1 with a 13.2% increase. Both hybrids have achieved statistical differences in production compared to the average of the experience (distinctly significant or significant). Lower productions were recorded at Autumn Queen F1 and Sarmash F1.

CONCLUSIONS

Following the experiment done to study the behavior of some autumn cabbage hybrids, in the conditions of the Transylvanian Plateau, the following conclusions were drawn:

- At the time of planting cabbage seedlings had a normal development in all cultivars used in the experience.
- Following a month after planting a better plant growth was found in Fieldglory F1, Bucharest F1 and Sarmash F1 hybrids.
- During the vegetation period cabbage plants had a normal development due to the conditions of culture provided.
- From the total weight of the plants, the head represent between 76.9% and 86.6%.
- Head production was between 57.6 t/ha at Sarmash F1 and 85.6 t/ha at Bucharest F1.
- Compared with the experience average, Bucharest F1 hybrid recorded a 16.1% increase in production, followed by Royal Dinasty F1 with a 13.2% increase.

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