

THE POSSIBILITY OF ESTABLISHING A GOJI CULTURE AND ITS EFFICIENCY THROUGH ADAPTATION TO THE PEDOCLIMATIC CONDITIONS OF GORJ COUNTY

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Abstract

In the current agro-economic context, for the rural development of Gorj County, it is important to identify new, attractive, but also economically efficient businesses. Starting from the fact that the interest in Goji fruits has increased significantly, along with their use in organic food and in traditional medicine, and the adaptation of this shrub to the pedoclimatic conditions in Gorj County, if the culture technology is respected, this study presents the possibility of establishment and capitalization of a culture that is not specific to the area, but which, through its characteristics, can adapt to the pedoclimatic conditions in Gorj County. Following the economic analysis, it is demonstrated that this business has a positive impact on the sustainable development of the rural area of Gorj County, on the economy, on the social life and on the environment, by capitalizing of agricultural land, creating jobs, promoting the area and increasing the income of entrepreneurs.

Key words: culture, economic efficiency, Goji.

INTRODUCTION

Goji berries have been known for over 2000 years, but interest in them has increased significantly with their use in organic food and traditional medicine due to their antioxidant content.

Goji shrub has the advantage, being not pretentious to environmental conditions, it adapts easily, but it is preferable to plant it in a sunny place and with enough space to grow.

The growth of the goji plant does not involve difficulties, resisting low temperatures of -25°C in the first two years and of -30°C in the following years, as well as to peaks of up to $+40^{\circ}\text{C}$. (Bordes, 2008; Kourdi, 2011).

Goji has the scientific name *Lycium chinese* and *Lycium barbarum*, being a shrub of the *Solanaceae* family, originally from Tibet, belonging to the same family as tomatoes, potatoes and eggplants.

Both species produce many ellipsoidal fruits with a bright red-orange colour.

The flowers are small, purple in colour and appear in the summer between June and September (Babuc, 2012; Sharamon, 2009) (Figure 1).



Figure 1. *Lycium barbarum*

The composition of dried goji berries/100 g is as follows:

- energy 1461 kJ (17%);
- protein 12.1 g (24% more than cereals);
- carbohydrates 57.82 g (60%);
- fat 0.73 g (1%);
- fibres 7.78 g (43%);
- vitamin C (400 times more than oranges);
- vitamins A (role in improving vision), B1 (thiamine), B2 (riboflavin), B3, B6 (necessary for the biochemical processes of

transforming food into energy, helps metabolism), B12, E (prevents the occurrence and evolution of atherosclerosis) (Şengün & Kadakal, 2021);

- different amino-acids (L-glutamine and L-arginine, important in improving growth hormone levels and gluten, important in the fight against free radicals, which turn in the body into gluten peroxidase, a very powerful antioxidant);

- 21 minerals (Ca, P, Zn, K);

- 21 microelements (Fe, Mg, K, With, like, P, Zn, Ge, Se);

- antioxidants (goji berries are the most effective fruits);

- 29 fatty acids;

- beta carotene (can be compared with carrots, antioxidant and sun-protective effect);

- phytonutrients;

- betaine (beneficial in depression and anxiety; protects the liver), zeaxanthin (with protective effect on the retina), beta-sitosterol (treating impotence and prostate diseases; anti-inflammatory effect and significant role in lowering cholesterol levels), physalin (active compound that fights the main forms of leukaemia), lutein (regeneration of DNA and all body cells; antiviral effect), solavetivone (strong antifungal and antibacterial effect), cyperone (in cases of cervical cancer; blood pressure control), anthocyanins and saccharides (Donno et al., 2015).

The aspects for which account is taken in setting up a Goji culture are as follows:

- soil type (sandy, calcimorphic, luteous or brown soils);

- soil pH = 7.1-7.5;

- soil fertility (to determine the level and type of fertilizers and the fertilization plan);

- timing of the plantation care work;

- technology of culture;

- possibility of accessing European funds to cover part of the expenses (since 2018, the goji culture is eligible for financing with European funds);

- geographical area in which the plantation is established (on flat or sloping land, with rows oriented on the level curves);

- location in an area with at least 8 hours of sun/day, because the goji plant develops best in the presence of the sun (avoiding shady areas or with too much moisture);

- establish an efficient irrigation system (to increase the yield of goji berry crop and plant resistance);

- surrounding the area (to ensure and prevent investment safety issues);

- market insurance (in Romania there is only one collection centre for the members of the association).

Goji blooms at the earliest in May and bears fruit between June and November, with buds, flowers, green fruits and ripe fruits on the same branch. (Kulczyński & Gramza-Michałowska, 2016).

Production of 2-3 kg/plant occurs in plants over 3 years of age. The bearing fruit period of Goji berries in plants obtained from seeds is after 2-3 years, but from cuttings, from the first year. For a production-efficient, qualitative and quantitative culture with high yields, emphasis is placed on spraying, watering, cutting, fertilizer use and pesticide use. Cutting and structuring the shrub is paramount for the appearance, development and qualitative and quantitative production. The traditional way of shaping Goji shrub is in the form and structure of canopy, through which the sun and wind can pass, on 1, 2 or 3 floors. In this regard, cutting is done in winter or early spring, when the plant is in the vegetative rest period (Koçyiğit & Sanlier, 2017) (Figure 2).



Figure 2. Cutting the Goji shrub

MATERIALS AND METHODS

In order to highlight the economic efficiency regarding the establishment and capitalization of a Goji plantation in Gorj County, a plot with

an area of 7,100 m² was identified, in the extra village area, with the category of arable use. Regardless of the planting scheme applied, it is taken into account that the goji shrub needs a distance between plants of minimum 1.5 m in order to develop well, and the compliance with the recommendations contained in the goji shrub cultivation technology leads to an increase in the quality and quantity of production.

The technology for the establishment and cultivation of Goji berries is based on the following steps:

Land choosing

- the soil related to the land intended for the establishment of the Goji plantation must comply with the following conditions: good fertility, medium texture, clayey, sandy or loamy soil, permeable, pH = 6.1-8.1;
- existing water source nearby, for phytosanitary treatments and irrigation in case of excessive drought, during the months of July-August.

To carry out the pedological study, soil samples were collected from the land area and it was demonstrated that the land identified for planting has the following characteristics:

- texture = clayish on the surface (0-24 cm, horizon A0) and clayey alluvial and colluvial lutum, (in horizon Bt1, W, 58-75 cm);
- structure = finely porous;
- degree of compaction = medium;
- fertility = medium to low;
- pH = 5.4 (moderately acidic reaction);
- degree of saturation in bases (V%) = moderately mesobasic;
- content in humus = small;
- mobile phosphorus content = medium = 8.86 ppm;
- mobile potassium content = low = 112 ppm.

Land preparation

The technological works carried out for the establishment of the Goji plantation in semi-intensive system are as follows:

- delimitation of the land allocated to the plantation;
- land levelling (modelling of areas of land that favour water accumulation) (Figure 3);

- application of pesticides, with a role in combating diseases, insects and nematodes (Figure 4);
- fertilization with manure (in the amount of 40 to 60 t/ha, given the low fertility of the soil);
- basic fertilization with P and K (250 + 250 kg/ha or by the use of complexes);
- soil mobilization (50-60 cm deep, by unclogging or by scarification, through two perpendicular passes);
- plowing (at 27-30 cm);
- ploughing + levelling (two, perpendicular ways) (Figure 5).



Figure 3. Levelling and fertilizing with manure



Figure 4. Application of pesticides and soil scarification



Figure 5. Soil plowing and ploughing



Figure 8. Planting Goji berries and mounting the dripping system

Maintenance of culture throughout the year

- the culture should be cleaned of weeds and unproductive shoots, which grow from the root of the shrubs;
- early spring and late autumn, shrubs sprinkle with copper-based substances to protect the plant from pests;
- during summer and during flowering, can be stimulated the development of plants, by foliar sprinkle with various nutrients, which must comply with a fertilization plan made by specialists based on the carried-out soil tests;
- depending on the variety, Goji berries begin to bloom in May and bear fruit from June to October-November; after they begin to bear fruit, there are flowers, buds, unripe fruits and ripe fruits on the plant; in the first year of cultivation, emphasis should be placed on the formation and development of shrubs and not on fruiting; profit from the sale of Goji berries is obtained from the third year of cultivation;
- the soil maintenance system can be: black field (the soil is kept free of weeds and loose throughout the period, by digging dig through the plants) or grazing (on the interval between rows and black field on the row of plants, by manual weeding and weeding with Roundup, Glifogan herbicides);
- maintenance works in the crown are aimed at suppressing the main stem in the first 2 years at 1 m height and in the following years at 1.5-2 m, suppressing the side branches by maintaining a maximum of 4-5 shoots and removing the shoots from the base that develop very quickly but do not bear fruit.

Fruit harvesting

- Goji berries are harvested manually and staggered, depending on ripening of the fruits and can be consumed fresh or dry;
- Goji berries are perishable and require increased attention to handling, because they can easily oxidize;
- a shrub of over 4 years of cultivation produces 3-4 kg of fresh fruit;
- fruiting begins in the second year, but production is obtained after the fourth year of planting (Figure 9).



Figure 9. Harvesting Goji berries

RESULTS AND DISCUSSIONS

The investment required to set up 1 ha of Goji plantation is about 10,000-15,000 euros, which covers the purchase of the shrubs, the preparation of the land and the actual planting, taking into account that 3,000-3,500 shrubs are required for 1ha. The cost for obtaining the bio certification is 500-600 euros, which also covers laboratory tests that prove that the land is not polluted, and for shortening the conversion period, another application is submitted to the certification entity and new soil tests will be carried out, which cost another 500 euros.

In order to highlight the economic efficiency of initiating a business regarding the establishment and capitalization of a Goji plantation in Gorj County, on a land area of 7,100 m², are presented:

- the expenditure on setting up the Goji plantation (Table 1);
- the expenditure on the materials necessary for the establishment of the Goji plantation (Table 2);

- the expenditure on the maintenance of the Goji plantation, up to the entry on the start bearing fruit period (year I and II) (Table 3);
- the expenditure on the necessary materials for the maintenance of the Goji plantation in year I and II since its establishment (Table 4);
- the total expenditure on the establishment and maintenance of the Goji plantation in year I and II of growth, up to the bearing fruit period (type of expenditure on establishment and maintenance and total expenditure) (Table 5).

Table 1. Expenses for the establishment of the Goji plantation

Name of the agrarian work	Value workmanship (lei)	Value workmechanical (lei)	Value materials (lei)	Total costs (lei)
soil mobilization (unclogging or by scarification)	-	400	-	400
Plowing	-	300	-	300
fertilization with manure (30-40 t/ha)	-	100	3,000	3,100
application of pesticides (fighting diseases and pests)	-	50	150	200
soil plowing twice (levelling + incorporation of fertilizers and pesticides)	-	300	-	300
land marking (for planting)	60	-	598	658
digging holes (30 x 30 x 30)	125	-	50	175
distribution of tutors to pits	55	-	1,136	1,191
root shaping	67	-	30	97
mud preparation + mud soaking of roots	54	-	20	74
distribution of propagating material to pits	49	-	-	49
planting seedlings + watering	135	-	13,682	13,817
tying the shrubs to the tutors	56	-	50	106
spilling of the stems	54	-	35	89
sowing herbs on the interval between shrubs	-	150	750	900
TOTAL	655	1,300	19,501	21,456

Table 2. Expenditure on materials necessary for the establishment of the Goji plantation

Name of the material	UM	Amount	Value (lei)	
			UM	Total on the material
Goji seedlings	pieces	1,136	12	13,632
Wooden pickets	pieces	1,136	0.5	568
Manure	t	30	100	3,000
Wooden tutors	pieces	1,136	1	1,136
Binding foil	kg	1	50	50
Barracks	pieces	5	10	50
Hoes	pieces	7	10	70
Scissors for trees	pieces	2	15	30
Lime	kg	4	5	20
Paint brush	pieces	1	15	15
Roulette 50 m	pieces	1	30	30
Pesticides	pieces	2	75	150
Seed herbs (for grassing on intervals)	kg	15	50	750
TOTAL				19,501

Table 3. Expenditure for maintenance of the Goji plantation until the first and second year of growth

Name of the agrarian work	Workmanship value (lei)	Value of mechanical works (lei)	Material value (lei)	Total costs (lei)
Chemical fertilization (NPK = 300 kg/ha)	55	150	618	823
cutting (for crown forming)	180	-	100	280
phytosanitary treatments (at the vegetative resting period)	60	150	200	410
digging on the row of plants (2 works/year)	1,800	-	100	1,900
mechanical mowing (3-4 work between rows)	240	400	-	640
phytosanitary treatments (5-6 treatments during vegetation)	300	750	1,000	2,050
irrigation (400-600 m ³ /ha, 2-3 watering /year)	180	100	100	380
binding and driving of the stems and skeleton branches (2 works/year)	567	-	150	717
TOTAL				7,200

Table 4. Expenditure on materials necessary for the maintenance of the Goji plantation in year I and year II of its establishment

Name of the material	UM	The amount	Value (lei)
NPK complex fertilizers	K	215	618
Different tools	buc	10	200
Pesticides		-	1,200
Materials for binding			150
TOTAL			2,168

Table 5. Total expenditure on the establishment and maintenance of the Goji plantation in the first and second year of growth, until entering on the fruit phase

Type of expenditure	Value (lei)
Establishment of the Goji plantation	21,456
Materials necessary for the establishment of the Goji plantation	19,501
Maintenance of the Goji plantation until the first and second year of growth	7,200
The necessary materials for the maintenance of the Goji plantation in the first and second year of its establishment	2,168
TOTAL	50,325

For the expenses related to the establishment and maintenance of the Goji plantation in the first and second years after its establishment, are presented for each type of agricultural work carried out, its position in the normative, the category of works, the value of the labour for each work, the value of the mechanical works carried out, the cost of the materials and total expenditure on the establishment and maintenance of the Goji plantation up to the entry on the start bearing fruit period, i.e. the first and second year of growth (Table 1 and Table 3).

For the expenditure on materials necessary for the establishment and maintenance of the Goji plantation in year I and II of its establishment, Table 2 and Table 4 present the name of the materials, the unit of measurement, the quantity required, the value per unit of measure, Total value for each material and total expenditure on the materials necessary for the establishment and maintenance of the Goji plantation in year I and II since its establishment.

Analysing the data presented, regarding all types of expenses necessary for setting up a Goji plantation, on an area of 7,100 m² in the Gorj County, it is noted that the initiation of this business has economic efficiency, contributes to the rural development of the commune and to the promotion and development of agro tourism in the area.

Goji plants enter on the fruit phase since the third year of planting, but the economic efficiency is achieved after the 4th-5th year.

- Production potential = 2-4 kg/fruit/plant
- Estimated production = 1,600 plants/ha x 3 kg/plant = 4,800 kg fruits
- Price of valorisation = 50 lei/kg of fresh fruits
- Production value/ha = 240,000 lei
- Value of production at cultivated area of 7,100 m² = 170,400 lei
- Profit starting with year 4 = income – expenses = 170,400 – 50,325 = 120,075 lei

CONCLUSIONS

Goji berries have been known for over 2000 years, but interest in them has increased significantly with their use in organic food and traditional medicine due to their antioxidant content

Goji berries can be eaten fresh or dried or can be used in various food industry preparations.

The initiated business has a positive impact on the sustainable development of the rural area of Gorj County, on the economy, social life and environment, by capitalizing on agricultural land, creating jobs, promoting the area and increasing the income of the entrepreneur.

REFERENCES

- Babuc, V. (2012). *Pomiculture*, State Agrarian University of Moldova, Practical Institute of Horticulture and Food technologies, Central Printing House, Chişinău, ISBN 978-9975-53-067-5.
- Bordes, J.P. (2008). *Goji, a genuine food for well-being*, Agen, Je médite.
- Donno, D., Beccaro, G.L., Mellano, M.G., Cerutti, A.K., Bounous, G. (2015). Goji berry fruit (*Lycium* spp.): antioxidant compound fingerprint and bioactivity evaluation, *Journal Funct Food*, 18, 1070-1085.
- Koçyiğit, E., Sanlier, N. (2017). A Review of Composition and Health Effects of *Lycium barbarum*, *International Journal of Chinese Medicine*, 1(1), 1-9. doi: 10.11648/j.ijcm.20170101.11.
- Kulczyński, B., Gramza-Michałowska, A. (2016). Goji Berry (*Lycium barbarum*): Composition and Health Effects - a Review, *Polish Journal of Food and Nutrition Sciences*, 66(2), doi:org/10.1515/pjfn-2015-0040.
- Kourdi, J. (2011). *100 Brilliant business ideas*, pp. 234. Adevărul Holding, Bucharest. ISBN: 978-0-462-09960-6.
- Şengün, P., Kadakal, C. (2021). Effect of Ripening Stages and Oven Drying on the Carotenoid Composition of Goji Berry (*Lycium barbarum* L.) Fruits, *Türk Tarım ve Doğa Bilimleri Dergisi*, 8(4), 1130–1138. <https://doi.org/10.30910/turkjans.976116>
- Sharamon, S. (2009). *La Baie de Goji*, Paris, Médicis. ISBN 978-2-8532-7395-4.