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The Importance of Starch-Sugar Crops in Rotation Systems

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ABSTRACT

In the research, the techniques to be used by the producers who produce starch-sugar crops in order to obtain the desired level of efficiency and quality, alternation techniques, selection of alternation techniques, shelf life and marketing status of the products obtained are important parameters. Agricultural production facilities and producers aim to determine the appropriate rotation system for the region in order to determine the product pattern that provides high income and does not reduce soil fertility and quality. Product selection, production methods and plant selection for rotation can direct their production according to the knowledge levels and habits of the producers. The income obtained by the producers from the plants they produce varies from year to year. For this reason, the market values and profitability of the plants alternated are also extremely important. The producers' rotation of plants with high adaptation to the region will help increase productivity and thus income levels. Researches are very important in determining the rotation system, plant selection and determination of the attitudes and behaviors towards determining the soil cultivation method. The purpose of the research conducted; The selection of suitable starch-sugar crops in the agricultural areas where rotation will be made, the high level of adaptation help to determine the rotation systems. Many studies related to the research in the world and in Turkey have been discussed. Important results have been obtained in line with the studies carried out.

Keywords: *Rotation, Rotation techniques, Starch-sugar crops, Yield.*

Rotasyon Sistemlerinde Nişasta-Şeker Bitkilerinin Önemi

ÖZ

Araştırmada, nişasta-şeker bitkileri üreten üreticilerin istenilen verimlilik ve kaliteyi elde etmek için kullanacakları teknikler, rotasyon teknikleri, rotasyon tekniklerinin seçimi, raf ömrü ve elde edilen ürünlerin pazarlama durumu önemli parametrelerdir. Tarımsal üretim tesisleri ve üreticiler, yüksek gelir sağlayan, toprak verimliliğini ve kalitesini düşürmeyen ürün desenini belirlemek için bölgeye uygun rotasyon sistemini belirlemeyi amaçlamaktadır. Ürün seçimi, üretim yöntemleri ve değişim için tesis seçimi, üreticilerin bilgi düzeylerine ve alışkanlıklarına göre üretimlerini yönlendirebilir. Üreticilerin ürettikleri bitkilerden elde ettikleri gelir yıldan yıla değişmektedir. Bu nedenle dönüşümlü bitkilerin piyasa değerleri ve karlılığı da son derece önemlidir. Üreticilerin bölgeye adaptasyonu yüksek bitkiler oluşturması, verimliliğin ve dolayısıyla gelir seviyelerinin artmasına yardımcı olacaktır. Araştırmalar, rotasyon sistemlerinin belirlenmesinde, bitki seçiminde ve toprak işleme yönteminin belirlenmesine yönelik tutum ve davranışların belirlenmesinde oldukça önemlidir. Yapılan araştırmanın amacı; rotasyon yapılacak tarımsal alanlarda uygun nişasta-şeker bitkilerinin seçimi, yüksek adaptasyon seviyesi ile münavebe sistemlerini belirlemeye yardımcı olmaktır. Dünyada ve Türkiye'de araştırmalarla ilgili birçok çalışma incelenmiştir. Yapılan çalışmalar doğrultusunda önemli sonuçlar elde edilmiştir.

Anahtar Kelimeler: *Rotasyon, Rotasyon teknikleri, Nişasta-şeker bitkileri, Verim.*

1. Introduction

Starch and sugar industries are among the most important branches of agriculture-based industry in Turkey as well as all over the world. Both industries are also the raw material producers of the food

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industry. Apart from this, it is a product that finds use in industries such as starch, paper, corrugated cardboard, textiles, and glue. For this reason, the production of plants used in starch and sugar production is of great importance for Turkey's economy. Starch sugar crops have an important place in the healthy nutrition of the increasing population of the countries. The fact that the nutrients removed in the highest amounts from the unit area and starch and sugar crops form their own sector and employment resources in the industrial sector shows the indispensability of the production of these plants. The rotation of other plants and starch-sugar crops in rotation systems will help increase the yield and quality of the product and maintain or increase the soil quality [1, 2, 3]. Starch and sugar crop cultivation; It contributes to the development of plant and animal production, the use of maximum industrial inputs, the improvement of the physical structure and ecological balance of the soils, and significantly increases the yield of the products to be cultivated after it. Cereals (especially wheat, corn and rice) and some tuberous plants (potatoes, sweet potatoes, kassava / tapioka, tarococoyam and yams) are the leading plants that are considered as starch sources in the world. For example, wheat kernels contain about 70% carbohydrates and about 97% of this carbonhydrate is starch. Starch content in grains is found at least in oat kernels and mostly in rice kernels. Apart from grains, the most important starch source is potato tubers. Apart from potatoes, artichoke, atat (sweet potato) and kassava tubers are also important starch sources. Approximately 18% of a potato tuber contains starch in the dry matter. Starch ratio is between 14-22% in white potatoes and 10-14% in yellow potatoes. The two most important vegetable raw materials of the sugar industry are sugar cane and sugar beet, but only sugar beet production is common in Turkey.

2. The Effect of Rotation on Yield in Some Starch and Sugar Crops

2. 1. Potato (*Solanum tuberosum*)

Potato (Solanum tuberosum) is a herbaceous plant species from the solanaceae (solanaceae) family whose tubers are eaten. It is a plant with white-pink flowers up to 70-80 cm in height. The tubers of the plant under the ground are known as "potatoes". Since these tubers are rich in starch, they are an important nutrient. In addition to starch, potatoes also contain a certain amount of protein. Starch is 20%, protein is 2%. The starch grains in potato tubers are in the form of eggs or pears and consist of 70-100 micron-sized grains. Potatoes are divided into yellow and red according to the outer skin color and white and yellow according to the inside. Potato seed is called milva. Turkey, especially in Nevsehir and Nigde made farming in the province [4]. A plant like potato that removes more nutrients from the soil cannot be grown in the same field for years in a row and with the same yield level, potatoes can be grown in the same field every 3 years, 2 years in a row, 1 year in 4 years, and there are different crop rotation systems. In all systems, it is necessary to take the edible or fodder legume plant for at least 1 year [5]. Although the degree of compatibility with the potato itself is moderate, it is not recommended to be planted in the form of monoculture because it has many diseases and pests [6]. The pre-plant value of potato varies depending on whether the varieties are early or late. Wheat is preferred after the late potato. Because the vegetation period is short in early varieties. During this period, excess nitrogen fertilizer is given. Most of this is left to the wheat. If wheat is planted after potatoes, excess nitrogen will lie. On the other hand, late potato varieties are not preferred in rye because they delay the planting time of rye. The same is true for barley. Potato that likes loose soil; plants that leave a lot of root residue in the soil grow very well, especially after legumes whose root parts contain too much nitrogen. For this reason, in general, potatoes must be planted behind perennial forage legumes in all climates and soil conditions. Thus, the yield of the potato can be increased by approximately 34%. The most suitable pre-plant for potatoes is sugar beet. Potato improves the physical properties of the soil and brings very few weeds. Potatoes are good preliminary plants for peas, beans and summer vetch. Because in this way, weeding decreases and productivity increases. Also for sunflower and rapeseed, potato is a good pre-plant. In regions where irrigation is available, but the sum of temperature is not sufficient to grow two crops in a year, potatoes can be planted with crops such as cereals, sugar beets, sunflowers, peas and beans. In places where irrigation is possible and the total temperature is sufficient to buy two crops per year, potatoes are grown in early season, followed by paddy, soy, sesame, peanut, corn and sunflower. If cotton is the main product, potatoes can be grown out of season and higher yields can be obtained from the second products behind [7].

2.2. Sugar Beet (*Beta vulgaris* L.)

Sugar needs of Turkey; It is met with white sugar produced from sugar beet and glucose and isoglucose produced from starch. Sugar beet is biologically a two-year plant. Vegetative organs develop in 1 year and generative organs in the second year. Its seeds are combined. In the first year, the root body, which acts as a sugar storage, and leaves on the ground, in the second year, it creates flowers and seeds. Its height varies between 85-180 cm depending on the place where it grows, climate and type. If seed production is not made, sugar beet is harvested in the year it is planted. It is planted in March-May and removed in September-November. The root stem it produces is processed in sugar factories. The European Union, USA and Russia take the first three places in world production. It is a commercial plant. 30% of sugar production in the world is obtained from sugar beet. Crop rotation is also important in sugar beet production. In a study conducted with a 4-year crop rotation (maize-wheat-sugar beet-sugar beet), it was observed that the root yields of sugar beet were positively affected. Again in a study; (barley-dry beans-wheat-maize-sugar beet), 5-year rotation was made and it was observed that the yield of sugar beet increased 22%. As a different crop rotation, 5-year rotation (barley-clover-alfalfa-dry beans-sugar beet) was tested, while the yield of clover increased 16%, while the yield of sugar beet increased 4%. As a result, a positive effect of rotation on yield has been observed in sugar beet [8].

2. 3. Sugar Cane (Saccharum officinarum)

Sugar cane is a perennial, 3-4 meters long, cane-like plant from the family of poaceae. It is mostly grown in hot and rainy countries in the world. It is very risky to grow sugar cane in places where frost is experienced. Rooted shoots are used as propagation material. These are sewn with a frequency of 180 x 90 cm. Approximately 80% of the sugar produced in the world is sugar cane sugar. Although the sugar rate in sugar cane is low (12-15%), the sugar yield per unit area is higher than sugar beet since it is formed many times (2-3 times) each year from perennial sugar cane plantations. Moreover, the cost of cane sugar is lower than the cost of beet sugar, since the fabrication of cane sugar is simple, easy and cheap. Although the sugar rate in sugar beet (15-20%) is higher, only one product is taken per unit area per year, the sugar yield is not as high as cane and the complexity of the industry increases the cost of sugar beet. Researchers have determined that sugar cane, which is almost not cultivated in Turkey, has important results in yield with rotation. Rotation of sugar cane with soybean and Lablab purpureus L.ex Sweet, a legume type, was used in rotation trials on sugar cane, and significant positive results were found in terms of both plant nutrients and the productivity of sugar cane in the environment where sugar beet was cultivated [9, 10].

3. Results

The place of starch-sugar crops in the rotation system is very important. Detailed information has been given on the effect of rotation systems on soil quality and plant yield and quality. In different regions of the world and Turkey in terms of efficiency and quality to the fore, it has been mentioned in crop rotation systems in positive effects on soil quality. In the researches, sugar beet, potato and sugar cane plants were generally used in terms of rotation systems in starch-sugar crops. In order to eliminate the negative effects of monoculture agriculture due to the constant intake of the same nutrients from the soil with monoculture agriculture, the increase of various diseases and pests, the decrease in product yield and quality, appropriate rotation systems should be implemented and planned for the regions. The characteristics of the plant species and varieties, soil structure, climatic conditions, weed, disease and pest, propagation status, transportation, storage and marketing characteristics should be taken into consideration when planning the rotation system with plants suitable for the regions and with high adaptability. Field moister capacity olmalı and organic matter content of the soil should be increased, soil fertility should be increased, in this context, a suitable environment for cultivated plants should be provided. With rotation, workforce planning in enterprises can be made much more comprehensive and appropriate. During the vegetation period of the plants, operations such as planting, care, harvesting, threshing and pre-planting soil preparation processes will be able to be efficiently applied without interruption.

As a result, it is possible to minimize the risks that will occur during crop production and to achieve maximum efficiency with rotation techniques.

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