Agrobiological Foundations of the Productivity of Sweet Clover

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Abstract: **High-yielding crops of rice, wheat and corn consume the main nutritious elements (NPK) from soil in large amounts, which remains in the crops (grain, straw). As a result, biogeochemical turnover of the main nutritious elements is violated in the crop rotation soils. In order to improve soil fertility, it is necessary to introduce and implement rice crop rotation and increase area for perennial herbs (lucerne and sweet clover). Perennial herbs (especially sweet clover) enrich soil with organic substances and nitrogen and contribute to return of nutritious elements back to soil. Based on the results of our scientific research, we determined the morphophysiological and agroecological parameters and properties of sweet clover agrophytocenosis ensuring heavy crop of green material and seeds in the conditions of irrigated rice cultivation and developed this agricultural crop cultivation technology flow scheme.**

Keywords: **Rice farming, crop rotation, sweet clover, morphophysiological and agroecological properties of sweet clover agrophytocenosis, rice cultivation technology flow chart.**

I. Introduction

The yellow sweet clover, known as the field melilot or yellow melilot, is a one-year-old or two-year-old grass belonging to the Fabaceae family. It is native to temperate and tropical Asia and Europe [1]. Melilotus officinalis is one of the most common species of the genus Melilotus. This species has an adaptation to environmental constraints, such as drought and cold [2] and salinity[3]. Melilotus is used as a soil cover in depleted soils [4], especially in moderately saline areas where traditional leguminous fodder can not be grown [5]. Melilotus officinalis is commonly found in the northern region of China, where it is used as green manure to improve soil fertility, and also as a medicinal plant.

Types of Melilotus, including yellow sweet clover, are not widely used in the production of feed due to their high content of coumarin. Kumarin, a secondary metabolite of plants, is associated with the production of dicumarol. Dicumarol is an anticoagulant that can cause hemorrhagic disease, known as sweet clover disease [6,7].

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Thus, the success of developing feed varieties based on any of Melilotus species will depend on a combination of increasing dry matter production and reducing coumarin content. The Melilotus breeding program at Lanzhou University is specifically focused on the development of new varieties with adaptation to the extensive medium-grazing habitats in China [8].

In connection with the aridity of the Aral Sea, the violation of the environmental conditions of the Aral Sea, the increase in salinity of the Syr Darya River and the increase in the level of groundwater, secondary salinization of the soil is intensifying. There was a transformation of meadow-bog soils into medium and heavily saline soils and solonchaks. At the same time, not only geophysical and meteorological conditions change, but biological and ecological equilibria are violated. Thus, in Kyzylorda oblast, 80-85% of the 217.6 thousand engineering-prepared orchards are saline in medium and strong extent, and 28.3 thousand hectares of land are not used because of salinity and waterlogging and have left the agricultural turnover. One of the stages of improving secondary soils and biological melioration is the cultivation of a sweet clover, which is comparatively stable to such conditions. Compared with other cultures, the sweet clover absorbs more insoluble compounds and, thanks to nodule bacteria in the roots, absorbs atmospheric nitrogen and accumulates it in soils. The use of clover as a green fertilizer enhances the microbiological activity of the soil, increases the fertility of the soil and suppresses the development of phytopathogenic fungi.

In the conditions of the Aral Sea region Kazakhstan from 1965-1966. rice farming developed intensively, in 1980-1990. rice was annually cultivated on the area of 90-110 thousand hectares, the average yield of rice reached 49-52 c / ha, wheat and maize-22-30.8 c / ha. When such high yields are obtained, rice, wheat, corn from the soil absorb a large number of basic food items (NPK) and is carried away with a crop (grain, straw). As a result, biogeochemical turnover of basic nutrients is broken in soils of crop rotation. With prolonged flooding of rice checks, the supply of oxygen together with air stops, in the soils there is a recovery process, the mineralogical composition and nutrient elements along the vertical profile change. Such changes occur at a faster rate on soils with a close occurrence of groundwater and saline soils.

To change and improve above mentioned adverse environmental conditions, increase soil fertility, get high and high-quality rice harvest, early grain crops and other crops, it is necessary to master the rice rotation, it is necessary to increase the sowing area of perennial grasses (alfalfa and sweet clover). In addition, it is necessary to make optimal doses of mineral and organic fertilizers. Perennial grasses (alfalfa, sweet clover) cultivated in rice crop rotation enrich the soil with organic substances (12-15 tons / ha). As a result, nutrients brought from the biological crop (grain, straw) of grain crops return to the soil and the "Law of the return of nutrients" of rice farming is preserved. Consequently, obtaining high yields, maintaining soil fertility and improving its physicochemical properties and destroying malignant weeds (perches, tuber kamysh, etc.) are possible only on highly productive, optimal densities of clover crops and in rice crop rotation. The research object is sweet yellow (MelilotusofficinalisDesr), Siberian Yellow. Applied fertilizers: granular superphosphate (P2O5-20.5%), ammonium sulfate (N-20%). Fertilizers (phosphorus, nitrogen, manure) are introduced before sowing for disking. The seeds of the clover are sown by the ordinary method (15 cm spacing), the seeding rate is 18 kg / ha.

II. Research results

Based on the results of their scientific research, the morphophysiological and agroecological characteristics and properties of the sweet clover have been established, forming a high yield of green mass and seeds under conditions of irrigated rice farming, and a scheme for cultivating this crop has been developed (Table 1). Environmental factors that influence the formation of a high and ecological net green mass of the clover are the changes in the soil and climatic conditions of the Aral Sea, the dynamics of the Great and Small Aral Sea, the amount of water supplied by the Syr Darya and the salts dissolved in it, secondary salinization of the soil.

Fig.1. Sweet clover yellow (Melilotus officinalis Desr.)

Table I. The Main Morphophysiological, Agroecological And Technological Factors, Which Form A High Yield Of The Green Mass Of Sweet Clover (Agro-Technological Schemes Of Cultivation)

Agroclimatic factors	The main climatic factors during the germination of seeds and the growing season
Soil-meliorative conditions	Soil types, fertility, salinity, nutrient content in soils, weediness
Varieties, phenotypes	Varieties and forms resistant to salinity, high temperature and drought, more accumulating nitrogen in the roots and soil, due to nodule bacteria
Physical stimulants, growth regulators	Seed treatment by electric field of corona discharge, growth regulator "AGRO-L", seed treatment by other methods
Agrotechnical Events	Place in the rice crop rotation, its predecessors
	Soil cultivation after harvesting predecessors and before sowing
	Determination of optimal doses, methods and timing of the introduction of mineral fertilizers
	Terms, norms, methods of sowing and depth of seeding
	Establishment and improvement of the irrigation regime
	Care of crops, the formation of optimal density of crops, a slope 1-2 times for vegetation, weed (weeping, tuber, etc.)
Characteristics and parameters of high-productive (op-timalnogo density) agrocenoses of the Don	The first year - the number of plants with germination - at unfavorable years - 260-280 pcs / m2, favorable years - 510-650 pcs / m2, height of clover - 70-110 cm, branching - 20,5-22,0 pcs. on each stem.
	The first year after the first cut, the number of plants: with favorable years - 450-650 pcs / m2, the height of the clover - 94.5-106.2 cm, branching - 20.5-22.0 pcs. on each stem
	In the second year - after wintering, the number of plants is 240-330 pcs / m2, the height of the clover is 110-145 cm, branching is 21.5-31.5 pcs. on each stem. Such a density of agronomy of the clover completely destroys the malignant weeds

Agroecological factors include changes in climatic and agro-meliorative conditions of irrigated rice farming, groundwater level and their mineralization, morphological and agrochemical characteristics and physical properties of the soil. The formation of highly productive agrocenoses of the sweet clover is influenced by its morphophysiological properties and signs. This includes the formation of the assimilating leaf surface, the height of the plants, its branching, the growth of the root system into the depth, the rapid growth after the first cut in the heat (38-470 ° C) in June, July, August, and resistance to windsweeps. Due to such properties, the clover grows rapidly after the cuts, shade the weeds, drain the top layer of the soil (where the root system of weeds is located - the seedling, the tuber), and destroy these malignant weeds after 1-2 cuttings in the first and second years of life.

In addition, the timely and high-quality implementation of agrotechnological measures, the introduction of optimal deadlines, the norms and methods for introducing mineral fertilizers, the treatment of seeds by corona discharge of the electric field and growth regulators contribute to the stability

of the sweet clover to unfavorable conditions and increases its competitiveness against weeds (Table 2).

TABLE II. ECOLOGICAL, AGROECOLOGICAL, MORPHOPHYSIOLOGICAL AND TECHNOLOGICAL FACTORS THAT FORM THE HIGHLY PRODUCTIVE AGROCENOSES OF THE CLOVER.

<table>
<tr><td colspan="4">Donnik (Melilotusofficinalis Desr., Sort of sweet clover yellow); factors that form high-productive, optimal density of crops, overwhelming and exterminating malignant weeds (sycophants, tubers, etc.)</td></tr>
<tr><td>Environmental factors</td><td>Agro-ecological factors</td><td>Morphophysiological properties</td><td>Agrotechnical factors</td></tr>
<tr><td>1. Soil-climatic conditions of the zone of rice cultivation and its changes in recent years
2. Properties and changes in the Aral Sea;
3. The amount of water and salts added to the Aral Sea;
4.Dynamics of the water level of the Great and the Ma-Aral Sea
5. Groundwater level and soil salinity</td><td>1. Climate change in the region of irrigated rice farming;
2. Agromeliorative conditions of irrigated lands;
3. Mineralization of groundwater;
4. The number of residual water;
5. Agrochemical characteristics of the soil and its physical properties</td><td>1.Photosynthesizing systems and systems accumulating spare substances;
2. Forming an as-similating sheet surface;
3. Morphysiological features: height of plants, branching, root growth in depth;
4. Rapid growth of the donkey after the first cut;
5.Stability of hot climate, drought, withering wind</td><td>1. Place in rice, cotton, vegetable crop rotations;
2. Formation of agricots of the clover;
3. Soil treatment, seeding, care of crops, cleaning;
4. Norms, terms, ways of introducing mineral fertilizers;
5. Seed treatment by corona discharge of electric current;
6. Application of AGRO-L growth regulator;
7. Using don-nick for various economic purposes</td></tr>
<tr><td colspan="4">Highly productive (optimal density) agrocenosis:
Number of plants by shoots - in unfavorable years: 260-280 pcs / m2, in favorable years: 510-650 pcs / m2, plant height - 70-110 cm, branching -14.7-21.1 pcs / stem. Stability after the first cut on high temperature, drying up winds and rapid growth of vegetative organs and roots.
In the second year, after wintering, the number of plants of the sweet clover is 240-330 pieces / m2, the height of plants is 110-145 cm, branching is 21.5-31.5 pcs / stem. With such agrocenosis, the clover completely destroys the malicious weeds, accumulates more organic matter and nitrogen in the soil.</td></tr>
<tr><td colspan="4">The soil:
In unfavorable years, phosphorus P60 kg / ha ae should be applied to the field of sweet clover, and in favorable years - P90 kg / ha.</td></tr>
</table>

III. CONCLUSIONS

In the field of sweet clover, located after two years of growing rice in unfavorable years, it is necessary to apply phosphorus fertilizers in a dose of P60 kg / ha ai, and in favorable years - P90 kg / ha. On such agronocenoses of the clover, a high yield of green mass is formed and the growth and development of weeds is strongly suppressed, especially after 1-2 cuttings (tables 1,2)

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