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Review Article

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Agriculture High Quality Development

Zhongsheng Guo[1,2]

[1]*Northwestern A & F University, Yangling, China*
[2]*ISWC, CAS & MWR, Yangling, China*

[*]**Corresponding author**
Guo Zhongsheng, Northwestern A & F University, Yangling, China, ISWC, CAS & MWR, Yangling, China.

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ABSTRACT

Since 2017, China put forward high-quality development, so, agriculture development had entered the new stage of high-quality development. Agriculture high quality development is to take some measures and methods to make the land produce the maximum output and services to meet people's yearning for a better life and agricultural production services. The theoretical foundations of Agriculture high quality development is the resources use limit by plants, vegetation carrying capacity and critical period of plant resources relationship regulation, which includes space resources use limit by plants, space vegetation carrying capacity and the critical period of plant space resources relationship regulation in soil water and soil nutrient rich regions; soil water resources use limit by plants and soil water vegetation carrying capacity and critical period of plant water relationship regulation in water limited regions, and the soil nutrient resources use limit by plants and soil nutrient vegetation carrying capacity and critical period of plant nutrient relationship regulation. The methods of Agriculture high quality development are to select the best species or variety, determine the suitable initial plant density, and regulate the plant resources relationship in the process of plant growth to get the maximum yield and benefits to realize the sustainable utilization of natural resources and the high-quality development of agriculture. In the future, we must strengthen the basic research of agriculture and select the best species or variety, determine the resources utilization limits by plants, the vegetation carrying capacity and the critical period of the adjustment of plant resource relations in different sites, and then take effective measures to get the maximum yield and benefits to realize the sustainable utilization of natural resources and the high-quality development of agriculture.

Keywords: Agriculture, High Quality Development, Resources use Limit by Plants, Vegetation Carrying Capacity, Critical Period of Plant Resources Relationship Regulation, Maximum Yield and Benefits, Sustainable Utilization of Natural Resources, New Quality Productivity

Introduction

Agriculture is the foundation of high-quality development. And Agricultural development has gone through a long process. According to the efficiency of resources plants use, agricultural development can be divided into three stages, original agriculture stage, yield and quality increasing stage and Agriculture high quality development.

In the first stage of agricultural development, that is, the primitive agricultural stage, the population is small, living by picking wild fruits, and the utilization rate of resources is low.

The second stage of Agriculture development is the yield and quality increasing stage. The turning point of original Agriculture stage into the yield and quality increasing stage is the domestication of wild plant and breeding for high yield and better quality. In the yield and quality increasing stage, because the production and service made by native vegetation cannot meet the need of people, so most of old forest become into non-native vegetation, such as forest, grass, fruit and crops. At this stage, people cultivate and use better plant species or varieties, apply chemical fertilizer and pesticide and irrigate and so on to increase the plants yield and quality. Due to a large number of excellent plant species or varieties in the production and cultivation process of artificial vegetation, there are unscientific phenomena such as over application of chemical fertilizer and spoiled use of pesticides, which are prone to overload leading to soil degradation, vegetation decay and crop failure or underloading, leading to resource waste and environmental pollution, which influence the quality and the quantity of Agricultural production and service, and cannot obtain maximum yield and benefits and meet people's yearning for a better life and agricultural needs. So, the Agriculture development enters the new stage of high- quality production [1]. Since 2017, China development

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was changed from high-speed development into high-quality development, so, Agriculture development had entered the new stage, The high-quality development of agriculture is to take some measures and methods to make the land produce the maximum output and services to meet people's yearning for a better life and the needs of agricultural production services [1].

However, because crop land change alters the plant resources relationship, easily resulting in soil and vegetation degradation and crop failure because of overload, or resources waste because of low load, both are unfavorable for the sustainable utilization of nature resources and crops high-quality production. Therefore, it is necessary to select excellent species or varieties according to the site condition and the market need, adopt appropriate initial planting density, and take effective measures, such as weeding, fertilizing and watering and so on to regulating the relationships between plant growth and resources supply and consume in the process of crop production to obtain the maximum yield and benefits and realize the sustainable utilization of natural resources and achieve high quality agricultural production.

The theoretical foundations of agriculture high quality development

The theory foundation of Agriculture high quality development is the resources use limit by plants, vegetation carrying capacity and critical period of plant resources relationship regulation, which includes the spaces resources use limit by plants and spaces vegetation carrying capacity and critical period of plant space relationship regulation in soil water and soil nutrient enough regions; soil nutrient resources use limit by plants and soil nutrient vegetation carrying capacity critical period of plant nutrient resources relationship regulation in nutrient limited regions and the soil water resources use limit by plants (SWRULP) and soil water vegetation carrying capacity (SWVCC) and the critical period of plant resources relationship regulation in water limited regions. The critical period of plant resources relationship regulation is the critical period of plant water relationship regulation in water limited regions Because the main factors affecting plant growth are different in different regions.

Resources use limit by plants

Nature resources is limit, so the resource plant used is limit. the limit is the resources use limit by plants. Resources use limit by plants includes space resources use limit by plants in soil water and nutrient rich region, soil water resources use limit by plants in water-limited regions and soil nutrient resources use limit by plants in soil nutrient limited regions. For example, in water-limited regions, the soil water resources use limit by plants in the water-limited region is the soil water resources when the soil water content in the maximum infiltration depth.

Soil water resources, proposed by Budagovski in 1985, is a good resource [2]. The resources use limit by plants is the soil water resources in the maximum infiltration depth (MID) when the soil water content in every soil layer equal to wilting coefficient, which changes with vegetation type and site condition. For example, the precipitation changes and the infiltration depth change with time in the Red Plum Apricot Orchard in semi-arid loess hilly region (Guyuan, China) see figure.1 and figure.2. The soil water suction change with soil water content at the same soil depth, see figure 3. [1,3].

Briggs and Shantz emphasized the importance of the wilting coefficient [4]. Richards and weaver (1943) observed that soil water potential at wilting ranged from -0.1×10^6 to -0.2×10^6 MPa, with an average of approximately -0.15×10^6 MPa (15 bar). Therefore, the water content at -0.15×10^6 MPa is the point at which soil moisture usually becomes limited severely [5]. The wilting coefficient is equal to the soil water content when soil water suction is equal to 15 Ba because the wilting coefficient changed with plant species with a range from 10 Ba to 20 Ba, which change with soil depth and expressed by the wilting coefficient of indicate plant in a plant community.

Vegetation carrying capacity

Vegetation carrying capacity (VCC) is the ability of land resources to support vegetation, which was expressed by the population or density of indicator plants in a plant community and changes with vegetation type, time (climate change) and site condition [1,3,6-9]. vegetation carrying capacity includes spaces vegetation carrying capacity in soil water and soil nutrient enough regions, Soil nutrient vegetation carrying capacity and soil water vegetation carrying capacity (SWVCC) [8-12].

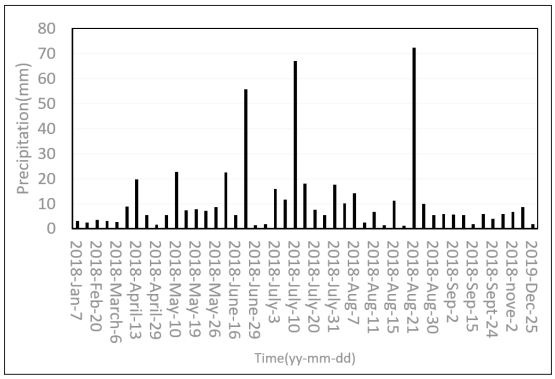

Figure 1: The change of precipitation with time in Red Plum Apricot Orchard in semi-arid loess hilly region (Guyuan, China)

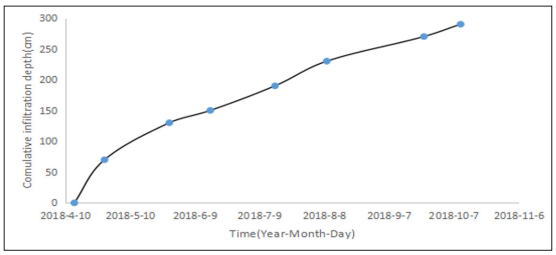

Figure 2: The change of infiltration depth with time in Red Plum Apricot Orchard in semi-arid loess hilly region (Guyuan, China)

The critical period of plant resources relationship regulation

The plant resources relation change with plant growth. When the plant is small, the plant available resources in crown or root are smaller than the resources use limit by plants, the plant resources relation is good and plant grow well. If the plant available resources in crown or root are equal to the resources use limit by plants, the plant resources relation enters the critical period of plant soil relationship regulation. The ending time of the critical period of plant resources relationship regulation is the ineffective time of regulating plant resources relation. The critical period of plant resources relationship regulation includes critical period of plant space relationship regulation in soil water and soil nutrient

enough regions, the critical period of plant nutrient resources relationship regulation in nutrient limited regions and the critical period of plant resources relationship regulation in water limited regions. For example, in water limited regions, the soil water resources are the most important resources influencing plant growth. the critical period of plant resources relationship regulation in water limited regions is the critical period of plant water relationship regulation in water limited regions in semiarid loess hilly region. The ending time of red plum apricot is stop expanding on 15 July, So, the ending time of the critical period of plant resources relationship regulation for the red plum apricot is the 15 July. The critical period of plant resources relationship regulation for the caragana shrub in semiarid loess hilly region is the end of September because caragana shrub is soil and water conservation forest, which stop serving as conservating soil and water in the raining period.

Because the main factors affecting plant growth are different in different regions. If the soil water resources in the MID in the critical period of plant soil relationship regulation soil water resources is lower than the SWRULP, the plant water relation enters the critical period of plant soil relationship regulation (CPPSRR) [11,12].

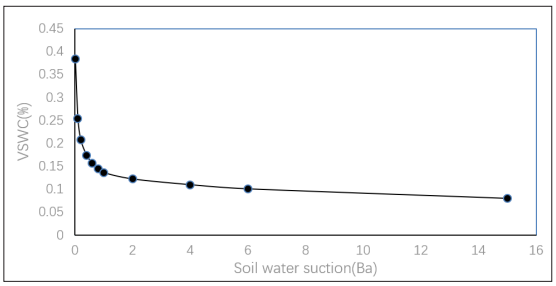

Figure 3: The change of soil water content with soil water suction at the same soil depth in Red Plum Apricot Orchard in semi-arid loess hilly region (Guyuan, China)

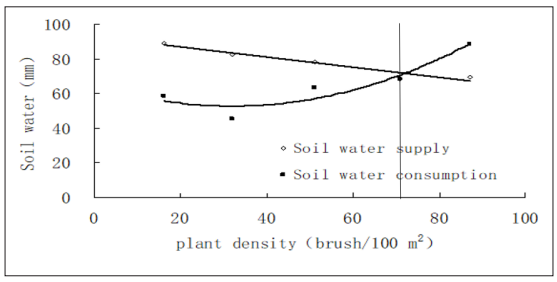

Figure 4: The relationship between plant density and soil water supply and soil water consumption and soil water vegetation carrying capacity (Two curve crosspoint) in the critical period of plant soil relationship regulation in caragana shrubland of semi-arid loess hilly region (Guyuan, China).

The ending time of CPPSRR is the ineffective time of plant soil relationship regulation. The relationship between plant density and soil water supply and soil water consumption in the critical period of plant soil relationship regulation in caragana shrubland of semi-arid loess hilly region see fig.4. (Guyuan, China). If present plant density is more than SWVCC in the critical period of plant soil relationship regulation, plant water relationship has must regulated based on SWVCC to get the maximum yield and service. For fruit trees or crops, the relationship between vegetative growth and reproductive growth should be reregulated according to the suitable leaf when the present plant density in the critical period of plant resource relationship regulation is equal to the vegetation carrying capacity, and the leaf and fine fruit relationship to obtain the maximum yield and benefits.]

The method of Agriculture high quality production

To carrying out Agriculture high quality development, we must make Agriculture high quality production. The basic methods of Agriculture high quality production as following:

Selection of better species or varieties

First, we must select better species or varieties according to the site condition and market need because better species or varieties influence the yield, quality and economic effect. Market influences the marketing of production. For example, in semiarid loess hilly region, the red plum apricot has been selected as the better species and promoted in large scale, See Fig.5 [13]. According to the market investigation in the 29th China Yangling Agricultural High-tech Achievements Expo, the fine apple cultivated by Luochuan fruit farmers is the fine apple with the diameter equal to or more than 90 cm. It is a good apple but it is a little bigger, one cannot eat an apple one time, so it is little big more and one cannot eat an apple a time, 85 apple is good, see figue.6. According to the investigation in Sichuan, China, the standard of prickly ash is different in Taiwan, Macau and Hongkong. We should take effect measure to produce different quality production and meet the need of different market.

Figure 5: The flower and fruit of red plum apricot in the semiarid loess hilly region (left photo is flower in May and Right photo is fruit in Junly)

Figure 6: The Market investigation of Luochuan Apple in the 29th China Yangling Agricultural High-tech Achievements Expo (left is market investigation of Luochuan Apple in May and Right photo is the fine apple cultivated by Luochuan fruit farmers).

Suitable Initial planting density

Planting density influences the plant growth and yield and service. If the Initial planting density is smaller, which influence the yield and benefits, so we must take the suitable initial

planting density. The suitable initial planting density is equal or more than vegetation carrying capacity because it is easier to reduce the plant density in the process of plant growth and use the natural resources in sustainable way. For example, in semiarid loess hilly region, the suitable initial planting density of caragana is 6500 trees per 100 m^2, and the sowing seed is 1.5 kg per 100 m^2. As for one year plant, such as pepper, see Figure 7, we can estimate the suitable Initial planting density according to the crown area per one standard plant with big fruit. The standard plant is a good plant with a maximum crown, yield and beneficial effect.

Figure 7: The author introduced to local people the method of estimating the suitable initial planting density of pepper based on standard plants in Xunhua, Qing Hai China in Semper, 2023. The right photo is the standard plants pf pepper with a height of 60 cm and a crown of 30cm×40cm and maximum yield and service.

Take effective measure to regulate the plant resources relation and get cultivated goal

Since weeds, fertilizer and water affect the growth environment of plants, and then affect plant growth, we must take effective measures such as weeding, fertilization according to the appropriate amount of fertilizer, irrigation according to the water requirement of plants and promote plant growth to get maximum yield and benefit to carry out cultivated goal. If available resources in crown layer in water and nutrient rich regions or root zone in water-limited regions or nutrient limited regions decrease to the limit of resource utilization by plant, the plant water relation enters the critical period of plant resources relation regulation. If the plant density exceeds the vegetation carrying capacity in the critical period of plant resources relation regulation, the plant resources relation should be regulated according to vegetation carrying capacity in the critical period of plant resources relation regulation [9,12]. We should take effective measures, such as weeding, fertilizing and irrigation (if having water resources) to ensure plant growth well in the process of production and get the cultivated goal. The cultivated goal is the need of market for production. if the production does not meet the need, you cannot get the benefit. If the plant density is more than the vegetation carrying capacity in the critical period of plant resources relation regulation, showing that the plant resources relationship should be regulated, otherwise the further increase of natural resources used by plant will lead to the decline of vegetation and the decline of grain yield and quality [3,6-8,12,14-16].

Conclusion

Agriculture is the foundation of high-quality development. Agriculture development has gone through a long time and now into the agriculture high quality development, which is to take some measures and methods to make the land produce the maximum output and services to meet people's yearning for a better life and the needs of agricultural production and services. The theory foundation of Agriculture high quality development is the resources use limit by plants, vegetation carrying capacity and critical period of plant resources relationship regulation, which includes space resources use limit by plants, space vegetation carrying capacity and the critical period of plant space resources relationship regulation , soil water resources use limit by plants and soil water vegetation carrying capacity and critical period of plant water relationship regulation, and the soil nutrient resources use limit by plants and soil nutrient vegetation carrying capacity and critical period of plant nutrient relationship regulation. The methods of Agriculture high quality development are to select better species or varieties, and take suitable initially planting density and effective measures to ensure plant growth well in the process of production and get the cultivated goal. From now, we must strengthen the basic research of agriculture, determine the utilization limits of plant resources, the carrying capacity of vegetation and the critical period of the adjustment of plant resource relations in different sites and different plant species, and then take the method of Agriculture high quality production, select the best plant species or varieties, take suitable initially plant density and effective measures to ensure plant grow well and get the maximize the yield and benefits to realize the sustainable utilization of natural resources and the high-quality development of agriculture.

Because of the large agricultural area and the increasing population, which has exceeded 8.2 billion at present, different regions have different crops suitable species or varieties suitable for growth, so it is necessary to strengthen the research on agricultural high-quality development to meet people's needs for a better life and crop types, yields and quality [17]. At present, I am leading the " innovation China", agricultural high-quality production and industrial service group to widely publicize and promote the new theories of the agriculture high-quality development, the theories of resource utilization limit, vegetation carrying capacity theory and the critical period theory of plant resource relationship regulation and take effective methods or measures to carry out sustainable use of resources and agriculture high-quality development to serve food security, rural revitalization and the construction of beautiful China.

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