

Development Status and Countermeasures of Agricultural Mechanization in Hilly Mountainous Areas of Yulin

Shuainan Liu

School of Management, Xi'an Polytechnic University, Xi'an Shaanxi, 710600, China

Abstract: During the "14th Five-Year Plan," Yulin's agricultural mechanization developed rapidly, hilly mountain agricultural production gradually from animal power-based to rely on mechanical power transformation. However, due to the restriction of natural conditions and development basis, there are still problems such as unbalanced development of agricultural machinery and equipment, imperfect service system of agricultural mechanization, the small scale of agro-machinery industry and insufficient input of agricultural scientific research in Yulin. In view of this, put forward the policy suggestions to promote the development of agricultural mechanization in Yulin: improve the effectiveness of infrastructure construction, strengthen the innovation of agricultural science and technology, construct the modern agricultural management system, increase the investment of agricultural machinery scientific research and other countermeasures.

Keywords: Hilly and Mountainous Areas; Agricultural Mechanization; Yulin; Current Situation and Countermeasures.

1. Introduction

The mechanization of agriculture is an important support to promote the transformation of traditional agriculture to modern agriculture, which is conducive to the transformation of agricultural production methods and the improvement of agricultural productivity. In recent years, with the further implementation of agricultural machinery purchase subsidies, the implementation of the measures of strengthening farmers to benefit, Shaanxi province agricultural machinery equipment in the total continued to grow, the level of operation is steadily improved. The total power of agricultural machinery in 2021 totals 24312.1 thousand kw, arable land area 3174.48 thousand hm², the overall mechanization rate of main crop cultivation is 71.1%. The development of agricultural mechanization continues to inject new kinetic energy into modern agriculture in Shaanxi Province, which has become an important driver of high-quality agricultural rural development.

The total land area of Yulin is 4292.02 thousand hm², the landform is divided into three categories: wind sand and grass beach area, loess hilly gully area, beam-like low hilly area. Among them, the loess hilly gully area is mainly in the southeast, with a total area of 58%, it covers the counties of Suide, Mizhi, Jia County, Wubu, Qingjian and Zizhou. The region's agricultural production is dominated by drought. Mainly cultivated are small grains, potatoes, corn, mountain apples, etc., the area of grain sown is 245.87 thousand hm², accounting for 33.8% of the city's total food area. During the "14th Five-Year Plan," the rapid development of agricultural mechanization in Yulin, the gradual renewal of agricultural machinery in hilly mountainous areas, agricultural production gradually entered a new stage dominated by mechanical power. In 2020, a high-standard farmland area of 1850 thousand hm² was added, with 67.19% of the overall mechanization level of major crop cultivation. However, there is still a large gap compared to the national average level of agricultural mechanization development of 71%. The 2023 Yulin Municipal Committee Working Meeting on Rural Areas

pointed out that we should continue to promote scientific and technological empowerment, continuously improve the level of agricultural mechanization, and further improve the level of integrated mechanization of major crops.

2. Development Status of Agricultural Mechanization

On the level of agricultural machinery and equipment, the total amount of agricultural machinery and equipment in Yulin increased significantly, the structure of agricultural machinery and equipment is continuously optimized, the main crop production machinery and equipment types are constantly abundant. In 2021, the total power of Yulin's agricultural machinery reached 3227.6 thousand kw, with all kinds of agricultural machinery 560 thousand units (sets). Of these, 24,139 large and medium-sized tractors, 27532 small tractors, 77308 tractors with agricultural implements, 3721 food crop combine harvesters and 2049 other crop combine harvesters [1]. The continuous abundance of agricultural machinery and types provides important equipment support for agricultural production and efficiency enhancement.

At the level of agricultural machinery, the area of machine farming in Yulin continues to expand, and the level of agricultural machinery work continues to improve. At the end of 2020, Yulin's machine farming area 0.69 thousand km², machinery sowing 4.4 thousand km², machinery tillage 2.7 thousand km², implementation of agricultural machinery deep pine ground 0.67 thousand km². Among them, Yuyang District is the first to become a national level basic to achieve the whole process of major crop production mechanization demonstration county, the total power of agricultural machinery in the region reached 470 thousand kw. In the spring farming operation of 2023, the full use of all kinds of agricultural machinery for production. More than 380 technicians have been deployed to the relevant departments. Guidance for more than 2,000 agricultural machinery households, overhaul of all kinds of agricultural machinery 400 (Set) to ensure the steady and orderly development of agricultural production throughout the year.

Agricultural machinery service organization, the number of service organizations continue to grow, the level of service continues to improve. By the end of 2020, Yulin had 502 agricultural machinery service organizations, 397 agricultural machinery professional cooperatives, 170,300 agricultural machinery households, 143,200 practitioners, small farmers and modern agriculture closer. Agricultural machinery socialization services continue to advance, order operations, hosting services, leasing and other service types are widely used, the field of work has gradually expanded to the entire field of agricultural production, agricultural machinery business services revenue reached 1768000 thousand yuan, an average annual growth of 1.3%.

On the input of agricultural mechanization, the investment and financing environment of Yulin has been continuously improved, with financial funds as the guide, gradually formed the farmer individual investment and social input interdependence of the diversified input mechanism. Agricultural production development in Shanxi Province in 2022 and 2023 accounted for 27.7% and 41.8% of agricultural and rural budget expenditure respectively, while science and technology transformation and extension services accounted for 9.1% and 10.4% of agricultural and rural budget expenditure respectively, it can be seen that Shaanxi province has increased the proportion of investment in agricultural production, science and technology transformation and extension [2]. As of October 2021, Yuyang District handled 324 agricultural machineries, subsidizing 296 households, subsidizing the amount of 33302 thousand yuan [3]. As of March 2022, Shenmu Agricultural Machinery Service Center has implemented a subsidized amount of 3280 thousand yuan to purchase 532 units (sets) of agricultural machinery, benefiting 400 farmers [4].

On the guarantee of agricultural machinery policy, Yulin's agricultural mechanization support policy support system is constantly improved. In recent years, Yulin has implemented agricultural machinery purchase subsidies, free management of agricultural machinery, deep pine land and other related policies, implemented a series of major projects including agricultural science and technology innovation platform construction project, high standard farmland construction project, agricultural mechanization promotion project, agricultural machinery extension project, agricultural IoT application training project, etc, around Yulin's characteristic food crop and hilly mountain main industry, promote agricultural mechanized production in the organization and management mode, technical system and equipment combination mode further update, for Yulin's agricultural mechanization of high-quality and efficient development of a solid foundation [5].

3. The Main Problems

3.1. Complex Terrain and Limited Agricultural Production

Yulin arable land area of 925.9 thousand hm^2 , located below 2 degrees slope (2 degrees) of arable land 257.7 thousand hm^2 , 27.84% of the city's arable land; at 2-6 degrees slope (including 6 degrees) of arable land 138.5 thousand hm^2 , 14.95%; at 6-15 degrees slope (15 degrees) of arable land 212.5 thousand hm^2 , 22.95%; at 15-25 degrees slope (including 25 degrees) of arable land 142.1 thousand hm^2 , 15.34%; arable land above 25 degrees of slope 175.2 thousand hm^2 , 18.92% [6]. Because Yulin arable land is

mainly distributed in low mountain and hilly area, there are a series of problems such as steep mountain slopes, rough roads and narrow fields, in addition to inadequate drainage and irrigation facilities, lack of machine access conditions, more difficult to adapt to mechanized operation requirements, agricultural production operations still face "inorganic availability" and "organic difficult" problems. Although in recent years Yulin has accelerated the improvement of agricultural production conditions, vigorously promoted the construction of high-standard farmland and the transformation of low- and middle-yielding fields, due to poor natural conditions, the high demand for funds, so that the area of cultivated land is still less. At present, most agricultural parks still face the problem of small size, high planting density and low inter-rows, the work area of suitable machine is still less, many large agricultural machineries are not applicable, restricting the development of agricultural mechanization in hilly mountainous areas [7].

3.2. Agricultural Machinery and Equipment Development Imbalance, Agricultural Machinery Extension and Application Difficulties

Yulin's agricultural machinery equipment ownership is increasing. However, the existing types of machinery are still single, the advanced application of intelligent agricultural machinery is less, small and medium-sized agricultural machinery varies widely in type and quantity, so that agricultural machinery and equipment in the variety type renewal, extension and application of the unbalanced development [8]. In particular, there is insufficient support available for agricultural machinery and equipment for hilly mountainous areas, the research and development of agricultural machinery equipment and technology suitable for Yulin mountain and soil texture is lagging behind. With the exception of micro-tillers, there is no corresponding type of equipment specifically designed to update the supply end for agricultural production in hilly mountainous areas. It has influenced the innovation and development of agricultural machinery and equipment to a certain extent, and there is a serious shortage of agricultural machinery and equipment. At the same time, because rural infrastructure construction is seriously lagging behind, the construction of road hardening infrastructure, irrigation infrastructure, agricultural machinery maintenance services, etc., is relatively lagging behind. The lack of supporting machine farming channels greatly limits the scope, area and efficiency of agricultural machinery. Together with the ageing of the existing rural labour force, it is more difficult for farmers to accept the upgrading of the equipment brought by technological progress, so that the introduction and spread of advanced machinery and equipment and advanced agricultural machinery technology are limited [9].

3.3. Agricultural Machinery Service System is Imperfect, Agricultural Machinery Professionals are Scarce

In recent years, Yulin's new agricultural machinery management body has continued to develop, and the social service system has gradually improved. By the end of 2020, Yulin had accumulated 349 agricultural industrialization leading enterprises, 9466 family farms, 10,926 farmer cooperatives, and 338.7 thousand hm^2 land trust services.

However, most agricultural machinery socialization service organizations are slow to replace the machinery, service function is weak, service radiation capacity is not fully adapted to the needs of agricultural mechanization development [10]. Yulin City, on the other hand, through the development of new vocational farmer cultivation project, Cultivation identified a number of new occupational farmers, but the rural labor force loss is serious, the hollow problem is still outstanding, the proportion of the working-age population engaged in agricultural production was 11.97 per cent. All categories of agricultural personnel account for only 2 per cent of the population in rural areas. Combined with the new types of agricultural management and the low incentive of vocational farmers, the comprehensive quality of the industrial body is not high, service ability and quality are not high, lack of complex talents who have agricultural machine operation and maintenance technology and are good at operating, so that Yulin's agricultural production and the demand of farmers cannot be adequately and effectively solved [11].

3.4. Small Scale of Agro-Machinery Industry, Insufficient Supply of Agro-Machinery

With the deep development of the agricultural machinery industry, more small and medium-sized enterprises began to anchor the agricultural machinery market, into the development and manufacture of agricultural machinery [12]. However, compared with the whole country, the development of Yulin's agro-machinery industry still has a small number of agricultural machinery R&D production enterprises and a small scale, the development of a single product, the city is in urgent need of agricultural machinery supply serious shortage of such issues. At the same time, agricultural machinery varieties and specifications are not many, agricultural machinery production and manufacturing is dominated by micro-tillers, effective supply is insufficient, farmers to agricultural mechanization of new equipment, new technology diversification requirements in the moment still cannot be met. The problem of structural defects in the supply of machinery and the need for farmers to rely on new agricultural machinery to increase their income is outstanding, far behind the demand for agricultural machinery products by rural mechanization. On the other hand, Yulin agricultural machinery research talent shortage, research, innovation ability is shallow, more simple imitation or simple reform, rarely organize independent innovation, so as to form malignant competition. Most of the key ring equipment introduced by foreign countries and provinces, the application range is narrow, some of the complex high-performance equipment introduction difficulties, affecting the improvement of the local level of agricultural mechanization.

4. Suggestions

4.1. Enhance the Effectiveness of Infrastructure Construction and Increase the Modification of Hilly Mountainous Areas

The first is to coordinate the land consolidation and strengthen the construction of high-standard farmland. To improve the infrastructure of farmland, improve the quality of cultivated land and improve the efficiency of resource utilization, integrated treatment of fields, soil, water, roads,

forests, electricity, technology and tubes, concentrating on land leveling, soil improvement and fertilization, irrigation and drainage, field roads, and farm transmission and distribution, gradual completion of the permanent basic farmland into high standard farmland. For the construction of high-standard farmland unified above the storage, establish the management and utilization mechanism, so that high-standard farmland, electromechanical irrigation, water network and other infrastructure better play long-term benefits. Secondly, we should strengthen the modification of hilly mountainous areas. Yulin slope $< 15^\circ$ of the arable land of 271.6 thousand hm^2 , accounting for 63% of the city's arable land area, the potential for organic transformation is great. To develop appropriate technical standards and specifications based on local conditions and scientific classifications for cultivated land with different slopes and features, adhere to "short change length, small change, bend straightening, grading, steep change," Improve the road required for mechanized production, promote the production of large-scale chip operation, further improve the level of mechanization. The third is to improve the participation and learning ability of the beneficiary and the farmer, so that a group of agricultural mechanization beneficiary and experts participate in the process of infrastructure construction, and accept the supervision of the masses, so as to enhance the professionalism, science and applicability of infrastructure construction.

4.2. Strengthen the Innovation of Agricultural Science and Technology and Promote the Extension and Application of Agricultural Machinery in Hilly

One is to actively dock all kinds of agricultural machinery scientific research institutions and high-tech enterprises, introduce and promote more suitable for hilly mountain cultivated land conditions, the practicalization of crop species, complete agricultural machinery equipment, increase the local supply of agricultural machinery, complete mechanized production of short boards. For example, Yulin has strengthened exchanges and cooperation with Yanglin District and Northwest A&F University, built a science and technology demonstration base, relied on the city's agricultural technology extension system, and implemented a coordinated agricultural technology extension program. Second, actively introduce and cultivate R&D talents, strengthen the municipal agricultural machinery research institutions and county agricultural machinery promotion team, to create a fusion of innovation team or industry alliance. For example, Yulin plays a variety of functions such as potato, mountain apple, small grain testing station agricultural science and technology innovation, science and technology promotion, technical services, etc., to enhance the transformation of scientific and technological achievements [13]. Second, to deal with the obstacles from the development of agricultural machinery to the application process, to listen to the suggestions of grassroots agricultural machinery management departments and agricultural machinery promotion agencies on the development and application of agricultural machinery in hilly mountainous areas. It provides the basis for solving the difficult problems in the development and application of agricultural machinery and equipment in hilly mountainous areas. The third is to actively promote the application of large-scale intelligent, high-end agricultural machinery, as well as agricultural aviation, remote sensing

technology, beidou intelligent monitoring terminal and auxiliary driving system integration technology, so as to promote the transformation and upgrading of agricultural equipment, improve the level of intelligent and automation of agricultural equipment. Fourth, carry out intelligent and efficient, green and environmental protection agricultural machinery and equipment research and development innovation and promotion applications. For example, Fugu County relies on the 2022 Yellow River basin agricultural surface source pollution control project, to distribute 100 single shaft stubble extinguishing machine and 500 straw rubbing machine, straw resource efficient use, waste as a treasure.

4.3. Enhancing the Capacity of Social Service and Constructing the Farmer Information Training System

The first is to consolidate and upgrade the agricultural management and service system led by farmers' family management, farmers' cooperatives, leading enterprises, and develop and nurture new types of agricultural management. For example, Yuyang District Yaoguo Farm through the formation of agricultural machinery cooperatives, the implementation of "small machine family, large machine mutual aid" agricultural machinery operation method, so that the whole process of food production mechanization. The second is to vigorously promote the professional training of agricultural machinery, promote the agricultural machinery socialization service organization management and management ability has been improved, to help the level of agricultural mobile phone service has been improved. Through expert teaching, online guidance, forum exchange and other means, carry out agricultural IoT skills and knowledge training, promote new occupational farmers, new business subjects to use new technologies, new equipment, new models to transform their traditional production management. For example, in 2023, Fugu County held a training course on spring farming preparation and farming machine operation, including farm machine field operation skills, farm machine maintenance and maintenance techniques, farm machine safety operation techniques, etc. The third is to strengthen the training of high-level talents, for family farmers, farmers' cooperatives to lead the whole industrial chain training, for large breeders, professional agricultural mobile operators to carry out key training. For example, "Yulin Leading High Quality Farmer Incubation Base" construction in Northwest A&F University, relying on the base to carry out the "leading type" "leading geese" and other rural industry revitalization leaders, technical personnel quality improvement training.

4.4. Increasing Investment in Agricultural Machinery Research and Strengthening Agricultural Mechanization Policy

First, strengthen the support of special funds for independent research and technical demonstration of agricultural technology, provide adequate scientific and technological support for the promotion of agricultural mechanization, and rigorously evaluate the investment of local matching funds for high-standard farmland construction. The second is to improve agricultural machinery acquisition and application subsidy policy, improve the proportion of agricultural machinery purchase subsidy in hilly mountains,

fully mobilize the enthusiasm of agricultural machinery professional cooperatives and other subjects to develop scale management [14]. Third, formulate special policies and initiatives in hilly mountainous areas. To popularize the whole mechanized production mode of potato, maize and rice, grasping hilly mountainous areas and dominance characteristic mechanization demonstration. In Yuyang, Hengshan, Dingbian and other places to build small grain, mountain apples and other characteristics of industrial mechanization demonstration sites, promotion of mechanical equipment and technology suitable for specialty industries [15]. Fourth, promote the development of Yulin's agricultural machinery industry. Establish a construction subsidy policy for science and technology enterprises to help agricultural machinery manufacturing enterprises clear the obstacles to development. To provide preferential credit policy for agricultural equipment manufacturing enterprises, to solve the shortage of funds for agricultural equipment production enterprises and loan difficulties. Fifth, grasp the agricultural machinery safety production. We will continue to implement the free-of-charge policy of agricultural machinery safety supervision, raise the registration rate, certification rate and inspection rate at the source, and create a good environment for agricultural mechanization development.

5. Epilogue

The level of agricultural mechanization in the hilly mountainous areas of Yulin is increasing year by year, and the development of agricultural mechanization in Yulin's "14th Five-Year Plan" is progressing steadily, but there are many development shortboards and obstacles. We should combine the advantages of local hilly mountainous areas to enhance the effectiveness of infrastructure construction, to enhance the modification of hilly mountainous areas and strengthen the innovation of agricultural science and technology, promoting the extension and application of agricultural machinery in hilly mountainous areas and enhancing the capacity of social services. We will build an information training system for farmers, increase investment in research funds for agricultural machinery and strengthen support for agricultural mechanization policies.

References

- [1] Shaanxi Statistical Yearbook 2022 [EB/OL]. (2022-11-23) <http://tjj.shaanxi.gov.cn/tjsj/nds/tjnj/sxtjnj/index.html? 2022>.
- [2] Report on the Implementation of the 2022 Budget and the Draft Budget for 2023 in Shaanxi Province[EB/OL].(2023-01-12) http://www.shaanxi.gov.cn/zfxxgk/fdzdgknr/ysjs/yjsbg/202301/t20230129_2273077.html.
- [3] Yu Yang District Agricultural and Rural Bureau accurately implement the agricultural machinery purchase subsidy policy [EB/OL]. (2021-10-27) <http://nyj.yl.gov.cn/#/article/1211027104129>.
- [4] Shenmu Farm Machinery purchase subsidy implementation of "one-stop" service, farmers save money and peace of mind! [EB/OL]. (2022-03-14)<http://nyj.yl.gov.cn/#/article/1220314093809>.
- [5] AN Lina.Countermeasures of agricultural mechanization development in Yulin City from the perspective of rural revitalization[J].Rural science and technology, 2021,12 (28): 118-120.

- [6] Yulin City Third National Homeland Survey Main Data Bulletin[EB/OL].(2022-06-29)[http:// zyghj.yl. gov.cn/ article Details. html?id=15735](http://zyghj.yl.gov.cn/articleDetails.html?id=15735).
- [7] BAI Li.Problems and functions of agricultural machinery development in hilly areas of Shaanxi Province[J].Agricultural Engineering Technology,2019,39(20):55.
- [8] WANG Xiangli,LI Feihong.Development status, problems and optimization measures of agricultural mechanization in Zizhou County, Shaanxi Province [J]. Agricultural Engineering Technology, 2021,41(29):56+58.
- [9] KANG Yun,ZHANG Hu.Extension and application of agricultural machinery technology in Jingbian county, Shaanxi province [J].Agricultural Engineering Technology, 2022, 42 (08): 46+48.
- [10] YU Bo. Yulin city, Shaanxi province to improve the level of agricultural mechanization to promote the sustainable development of agriculture[J].Agricultural Engineering Technology, 2019,39(17):53+55.
- [11] Yulin City "14th Five-Year" Construction Shaanxi Modern Agriculture Development Plan [EB/OL].(2022-03-02)[http:// drc. yl.gov.cn/ghwj/8821](http://drc. yl.gov.cn/ghwj/8821).
- [12] DAI Lijun, DING Hong.Problems and suggestions on the development of agricultural mechanization in China under the background of agricultural modernization[J].Agricultural Economy, 2023(01):33-35.
- [13] Notice of the Yulin Agricultural and Rural Bureau on the issuance of the "Agricultural and Rural Work Points of the City in 2023"[EB/OL].(2022-03-02)[http://nyj.yl. gov.cn /#/article/ 1230505171935](http://nyj.yl.gov.cn/#/article/1230505171935).
- [14] 2019 Yulin Agricultural Mechanization Work Points [EB/OL]. (2019-07-26)[http:// ylnjzx. com/ xwzx/ tzgg/ bueE7n.htm](http://ylnjzx.com/xwzx/tzgg/bueE7n.htm).
- [15] Yulin strives to promote the whole process of agricultural production mechanization[EB/OL].(2018-04-16)[http:// www. yl. gov.cn/P/C/7866.htm](http://www.yl.gov.cn/P/C/7866.htm).