Optimization of Crop Cultivation Based on Integer Programming Methods

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Abstract. In recent years, agricultural development has shown the development trend of precision, green and quality agriculture. At the same time, in view of the shortage of cultivated land resources caused by population growth and urbanization, it is of great significance to optimize crop planting strategies. Based on the assumption that the relevant data of crops are stable and considering the risk factors, a multi-objective optimization model based on linear programming is established in this study to solve the optimal planting scheme of crops in the next seven years under the conditions of slow sales and half-price sales. A mixed integer linear programming model is established to solve the planting strategy problem under uncertain conditions. An integer programming model based on multi-stage decision-making is established, which solves the multi-stage planting optimization problem. The aim is to realize agricultural high efficiency, environmental protection and sustainable development.

Keywords: Integer programming, Linear programming, Dynamic programming algorithm, Rural planting scheme, Crop planting income.

1. Introduction

Rural economy is crucial for the national economic structure. But with population growth and urbanization, cultivated land has become scarce, making it vital to optimize crop planting strategies for efficient land use [1]. This paper explores optimal crop planting, factoring in labor, market demand, and output. It considers costs, prices, and expected income to determine annual planting areas and labor distribution, aiming to maximize long-term benefits. However, crop cultivation is complex, influenced by water, fertilizer, climate, and land types like flat dry land, terraced fields, and irrigated land, each with different crop potential. Greenhouses also vary in capabilities. Given population trends and land shortages, optimizing strategies is essential, considering agricultural trends and food security.

This paper mainly studies the optimal planting of crops in a village in North China from 2024 to 2030. Limited by less precipitation and land use, most of the land in North China is suitable for planting grain crops in a single season. The village also has 1201 mu of open-air cultivated land and 20 greenhouses. Open-air cultivated land is divided into 34 plots with different sizes and types, including flat dry land, terraced fields, sloping fields and irrigated land. Flat dry land, terraced fields and hillside fields are suitable for planting grain crops in one season every year. However, irrigated land is suitable for planting one season of rice or two seasons of vegetables every year. There are also 16 ordinary greenhouses and 4 intelligent greenhouses, and the cultivated land area of each greenhouse is 0.6 mu. Ordinary greenhouses are suitable for planting one-season vegetables and one-season edible fungi, while smart greenhouses are suitable for planting two-season vegetables every year. Different crops can be planted in the same plot (including greenhouses) every season.

2. Literature review

A number of studies show that the academic circles are actively exploring the optimization of crop planting through many methods such as multi-objective optimization, two-stage stochastic planning and intelligent management, so as to realize the efficient, environmental protection and sustainable development of agriculture. Wu et al [2] used the multi-objective comprehensive optimization model to optimize and analyze the crop planting structure in the irrigation area, and discussed the possibility of rationally utilizing water resources and promoting the sustainable development of agricultural economy in the irrigation area by optimizing the crop planting structure. The results show that the optimization scheme of crop planting structure can not only save water, but also provide ecological and economic benefits. Li [3] and others adopted a multi-objective compromise model, aiming at economic benefits, water-saving benefits and ecological benefits, and taking the total cultivated land area, total water resources and food requirements as constraints to adjust the planting structure in Heilongjiang Province. Chen et al. [4] used the comparative advantage theory to build a comparative advantage model, and calculated the scale advantage index, efficiency advantage index and comprehensive advantage index of the main crops in southwest China, so as to improve the yield and quality of dominant agricultural products. Zhang et al. [5] In order to optimize the planting structure under limited agricultural water resources to achieve the maximum economic benefits, considering the uncertainties in hydrological factors and socio-economic factors in the process of planting structure optimization, a double-interval two-stage stochastic programming model with the goal of maximizing economic benefits was constructed. Aiming at the problem of low parking efficiency caused by turning and congestion in the process of automatic guided vehicles accessing vehicles in smart parking lots, Yu et al. [6] proposed a parking guidance path planning algorithm based on dynamic link cost. In order to improve the profitability of comprehensive oil companies and solve the optimization problem of multi-refinery production planning with integer variables and nonconvex bilinear constraints, Dong et al. [7] proposed a mixed integer nonlinear programming method based on continuous linear programming. Taking the water storage cooling system of a data center in Guangzhou as the research object, Zhang et al. [8] proposed a model predictive control method based on mixed integer linear programming. In order to solve the problems of low line balance rate and low output value of oil mill production line in workshop D of a furniture company, Guo et al. [9] established a 0-1 integer programming and objective programming model. Li et al. [10] used the TOPSIS optimal-worst distance method, 0-1 programming model, and integer programming model to evaluate and plan the procurement and transportation of raw materials for production enterprises.

The possible marginal contributions of this paper are as follows: In recent years, agricultural development has shown the development trend of precision, green and quality agriculture. At the same time, in view of the shortage of cultivated land resources caused by population growth and urbanization, it is of great significance to optimize crop planting strategies. Under the assumption that the relevant data of crops are stable and considering the risk factors, this study established a multi-objective optimization model based on linear programming to maximize the stable benefits, so as to solve the optimal planting scheme of crops in the next seven years under the conditions of slow sales and half-price sales. A mixed integer linear programming model is established to solve the planting strategy problem under uncertain conditions. An integer programming model based on multi-stage decision-making is established, which solves the multi-stage planting optimization problem. The aim is to realize agricultural high efficiency, environmental protection and sustainable development.

3. Model and method

3.1. Establishment of objective function

3.1.1. Analysis of Planting Scheme under Stability Assumption and Treatment Constraint

It is assumed that the expected sales volume, planting cost, yield per mu and selling price of various crops in the future will remain stable compared with 2023, and the crops planted every season will be sold in the current season. There are two ways to solve the planting scheme: more than part of it is unsalable, causing waste, and the income of this part is zero and the part of it is sold at a reduced price of 50% of the sales price in 2023. According to the above conditions, the decision variables are set, and the optimal planting scheme is solved with the optimization goal of maximizing benefits. The objective function is:

$$\text{Maximize} \sum_t \sum_i \sum_j \sum_k (P_{ik} \cdot \min\{Y_{ijk} \cdot x_{ijk}^t, T_i\} + \mu \cdot P_{ik} \cdot \max\{Y_{ijk} \cdot x_{ijk}^t - T_i, 0\} - C_{ik} \cdot x_{ijk}^t) \quad (1)$$

Where $P_{ik}, Y_{ijk}, x_{jjk}^t, T_i C_{jk}$ respectively represent the selling unit price of the crop with crop number I in the k season, the expected yield per mu of the crop with crop number I in the k season of plot J, the planting area of the crop with crop number I in the k season of the t year, the actual sales volume in 2023, and the planting cost of the crop with crop number I in the k season, μ is the discount rate, and its purpose is to distinguish between two different situations of slow-moving and half-price sales.

To make the planting position of crops conform to the actual situation, the following constraints are required.

$$\begin{cases} \sum_k x_{ijk}^t = s_j, \forall j \in \{A^{1\sim6}, B^{1\sim14}, C^{1\sim6}\}, i \in [1,15] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in \{16\}, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in [35,37] \text{ and } i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}, F^{1\sim4}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}, F^{1\sim4}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}\}, i \in [38,41] \text{ and } i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{F^{1\sim4}\}, i \in [17,34] \text{ and } i \in Z, k = 2 \end{cases} \quad (2)$$

In order to maintain soil fertility and improve crop yield and quality, continuous cropping cannot be carried out in the same area in consecutive years or seasons:

$$x_{ijk}^t \cdot x_{ijk}^{t+1} = x_{ijk}^t \cdot x_{ijk+1}^t = 0, \forall i, j, k \text{ and } i \in Z \quad (3)$$

Because legume crops are beneficial to soil health and sustainable agricultural development, legume crops must be planted in each plot (including greenhouse) once in three years:

$$\sum_{t=1}^3 \sum_i \sum_k x_{ijk}^t \geq s_j, \forall j, k, i \in [1,5] \cup [17,19] \text{ and } i \in Z \quad (4)$$

This constraint means that the area of beans planted in a certain area must be greater than 0 for three consecutive years, that is, beans must be planted within three years.

In order to promote the rational allocation of land resources, the planting area of crops should not be too small;

$$x_{ijk}^t \geq 0.5 \cdot s_j, \forall j \quad (5)$$

According to the analysis of existing data, the upper limit of planting different crops in the same plot of smart greenhouse is not more than 0.5 times of the area here. Strictly speaking, when different crops are planted in greenhouse areas, there are at most two kinds, each accounting for half.

3.1.2. Planting Scheme Planning under Risk Factors and Price Changes

Combined with practical experience, the expected sales volume and planting cost of different crops will change differently. The expected sales volume of wheat and corn has an increasing trend, with an annual growth rate of 5%-10%; The expected sales volume of other crops will change by 5% compared with 2023. The yield per mu of crops varies by 10% every year due to the climate. The planting cost is affected by market conditions and increases by about 5% every year. The sales price of grain crops is basically stable; The sales price of vegetable crops increases by about 5% every year. The sales price of edible fungi has declined steadily, dropping by 1%-5% every year, and the annual decline rate of Morchella is 5%.

Under the above conditions, the optimal planting scheme from 2024 to 2030 was designed with the maximization of benefits as the optimization goal. The objective function is:

$$\text{Maximize} \sum_t \sum_i \sum_j \sum_k \left(P_{ik}^t \cdot \min\{Y_{ijk}^t \cdot x_{jjk}^t, T_i^t\} + 0.5 \cdot P_{ik}^t \cdot \max\{Y_{ijk}^t \cdot x_{ijk}^t - T_i^t, 0\} - C_{ik}^t \cdot x_{ijk}^t\right) \quad (6)$$

P_{ik}^t represents the sales price of the crop with the crop number I in the k season in T year; Y_{ijk}^t represents the yield per mu of the crop with crop number I in block J in the k season of T year; T_i^t represents the total estimated sales of crops with crop number I in t years; C_{ik}^t represents the planting cost of the crop with crop number I in the k season in t year.

The estimated annual sales volume of crops varies randomly at fixed intervals:

$$\begin{cases} T_i \cdot [1 + X_1]^{t-2023}, i \in \{6,7\} \\ T_i \cdot [1 + X_2]^{t-2023}, i \notin \{6,7\} \end{cases} \quad (7)$$

Among them, the sales of wheat, corn and other crops are separated because of significant differences. X1 and X2 are random variables, X1 ~ U (0.05, 0.1) and X2 ~ U (0.05, 0.05).

The yield per mu of crops changes dynamically with time, with the range of [-0.1,0.1]:

$$Y_{ijk}^t = Y_{ijk}[1 + X_3]^{t-2023} \quad (8)$$

X3 is a random variable, which obeys the uniform distribution X3 ~ u (0.1,0.1).

The cost of crops will increase by 5% every year over time, that is:

$$C_{ik}^t = 1.05^{t-2023} C_{ik} \quad (9)$$

With the change of time, the sales prices of different kinds of crops have different dynamic changes, namely:

$$\begin{cases} P_{ik}^{2023}, i \in \{6,7\} \\ 1.05^{t-2023} P_{ik}, i \in \{17,37\} \\ P_{ik}[1 + X_2]^{t-2023}, i \in \{38,40\} \\ P_{ik} 0.95^{t-2023}, i \in \{41\} \end{cases} \quad (10)$$

3.2. Model establishment

3.2.1. Planting Scheme Model under Stability Assumption and Treatment Constraint

$$\text{Maximize} \sum_t \sum_i \sum_j \sum_k \left(P_{ik} \cdot \min\{Y_{ijk} \cdot x_{ijk}^t, T_i\} + \mu \cdot P_{ik} \cdot \max\{Y_{ijk} \cdot x_{ijk}^t - T_i, 0\} - C_{ik} \cdot x_{ijk}^t\right) \quad (11)$$

$$\text{s.t.} \begin{cases} \sum_k x_{ijk}^t = s_j, \forall j \in \{A^{1\sim 6}, B^{1\sim 14}, C^{1\sim 6}\}, i \in [1,15] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim 8}\}, i \in \{16\}, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim 8}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim 8}\}, i \in [35,37] \text{ and } i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim 16}, F^{1\sim 4}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim 16}, F^{1\sim 4}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim 16}\}, i \in [38,41] \text{ and } i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{F^{1\sim 4}\}, i \in [17,34] \text{ and } i \in Z, k = 2 \\ x_{ijk}^t \cdot x_{ijk}^{t+1} = x_{ijk}^t \cdot x_{ijk+1}^t = 0, \forall i, j, k, i \in Z \\ \sum_{t=1}^3 \sum_i \sum_k x_{ijk}^t \geq s_j, \forall j, k, i \in [1,5] \cup [17,19] \text{ and } i \in Z \\ x_{ijk}^t \geq 0.5 \cdot s_j, \forall j \\ \mu = 0 \text{ or } 0.5 \end{cases} \quad (12)$$

3.2.2. Planting Scheme Model under Risk Factors and Price Changes

$$\text{Maximize} \sum_t \sum_i \sum_j \sum_k (P_{ik} \cdot \min\{Y_{ijk} \cdot x_{ijk}^t, T_i\} + 0.5 \cdot P_{ik} \cdot \max\{Y_{ijk} \cdot x_{ijk}^t - T_i, 0\} - C_{ik} \cdot x_{ijk}^t) \quad (13)$$

$$\text{s.t.} \begin{cases} \sum_k x_{ijk}^t = s_j, \forall j \in \{A^{1\sim6}, B^{1\sim14}, C^{1\sim6}\}, i \in [1,15] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in \{16\}, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in [35,37] \text{ and } i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}, F^{1\sim4}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}, F^{1\sim4}\}, i \in [17,34] \text{ and } i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}\}, i \in [38,41] \text{ and } i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{F^{1\sim4}\}, i \in [17,34] \text{ and } i \in Z, k = 2 \\ T_i \cdot [1 + X_1]^{t-2023}, i \in \{6,7\} \\ T_i \cdot [1 + X_2]^{t-2023}, i \notin \{6,7\} \\ X_1 \sim U(0.05, 0.1), X_2 \sim U(0.05, 0.05) \\ Y_{ijk}^t = Y_{ijk}[1 + X_3]^{t-2023} \\ C_{ik}^t = 1.05^{t-2023} C_{ik} \\ \begin{cases} P_{ik}^{2023}, i \in \{6,7\} \\ 1.05^{t-2023} P_{ik}, i \in \{17,37\} \\ P_{ik}[1 + X_2]^{t-2023}, i \in \{38,40\} \\ P_{ik} 0.95^{t-2023}, i \in \{41\} \end{cases} \end{cases} \quad (14)$$

3.2.3. Planter Model under Substitution Complementarity and Comparative Analysis

$$\text{Maximize} \sum_t \sum_i \sum_j (P_{ik}^t \cdot \min\{Y_{ijk}^t \cdot x_{jjk}^t, T_i^t\} + 0.5 \cdot P_{ik}^t \cdot \max\{Y_{ijk}^t \cdot x_{ijk}^t - T_i^t, 0\} - C_{ik}^t \cdot x_{ijk}^t) \quad (15)$$

$$s.t. \begin{cases} \sum_k x_{ijk}^t = s_j, \forall j \in \{A^{1\sim6}, B^{1\sim14}, C^{1\sim6}\}, i \in [1,15] \ and \ i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in \{16\}, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in [17,34] \ and \ i \in Z, k = 1 \\ \sum_k x_{ijk}^t = s_j, \forall j \in \{D^{1\sim8}\}, i \in [35,37] \ and \ i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}, F^{1\sim4}\}, i \in [17,34] \ and \ i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}, F^{1\sim4}\}, i \in [17,34] \ and \ i \in Z, k = 1 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{E^{1\sim16}\}, i \in [38,41] \ and \ i \in Z, k = 2 \\ \sum_k x_{ijk}^t = 0.6, \forall j \in \{F^{1\sim4}\}, i \in [17,34] \ and \ i \in Z, k = 2 \\ x_{ijk}^t + x_{qjk}^t \le s_j \\ \frac{x_{ijk}^t}{x_{qjk}^t} \in [0.5, 2] \\ \frac{x_{ijk}^t + x_{qjk+1}^{t+1}}{s_j} \in [1, 2] \end{cases} \quad (16)$$

3.3. Data

The data source of this data is the crop planting situation and its statistical data in 2023, and the existing cultivated land types, areas and the types of crops planted in rural areas. Among them, A1-

A6 is flat dry land; B1-B14 are terraces; C1-C6 is a hillside; D1-D8 is irrigated land; E1-E16 are common greenhouses; F1-F4 are wisdom greenhouses.

4. Results and analysis

4.1. Analysis of Planting Prediction under Stability Hypothesis and Processing Constraints

By combining the linear programming with the multi-objective programming model, we get the results of some planting schemes from 2024 to 2030 as follows:

Table 1. Results of the unsalable portion of the planting program

Age	Plot name	Deep beam	Plot name	Black soya bean
2024	A1	40	A5	34
2025	A2	0	A2	27.5
2026	A3	0	A4	36
2027	A4	36	B3	20
2028	B1	30	B9	25
2029	B6	43	B11	30
2030	B11	40	C1	0

Table 2. The result of a partial planting program sold at half price

Age	Plot name	Deep beam	Plot name	Black soya bean
2024	A4	36	A2	27.5
2025	A5	34	B3	20
2026	B2	0	B4	14
2027	B6	43	B6	43
2028	B10	0	B9	25
2029	B11	30	B12	22.5
2030	C4	0	C1	0

Table 1 and Table 2 show the partial crop planting plan of the plot in 2024-2030. The planting scheme meets the requirements of discontinuous planting stubble, and the planting scale meets the conditions of non-dispersion and suitable area. The following figures 1 and 2 show the overproduction of some crops in 2024-2030 under the conditions of "slow sales" and "half price".

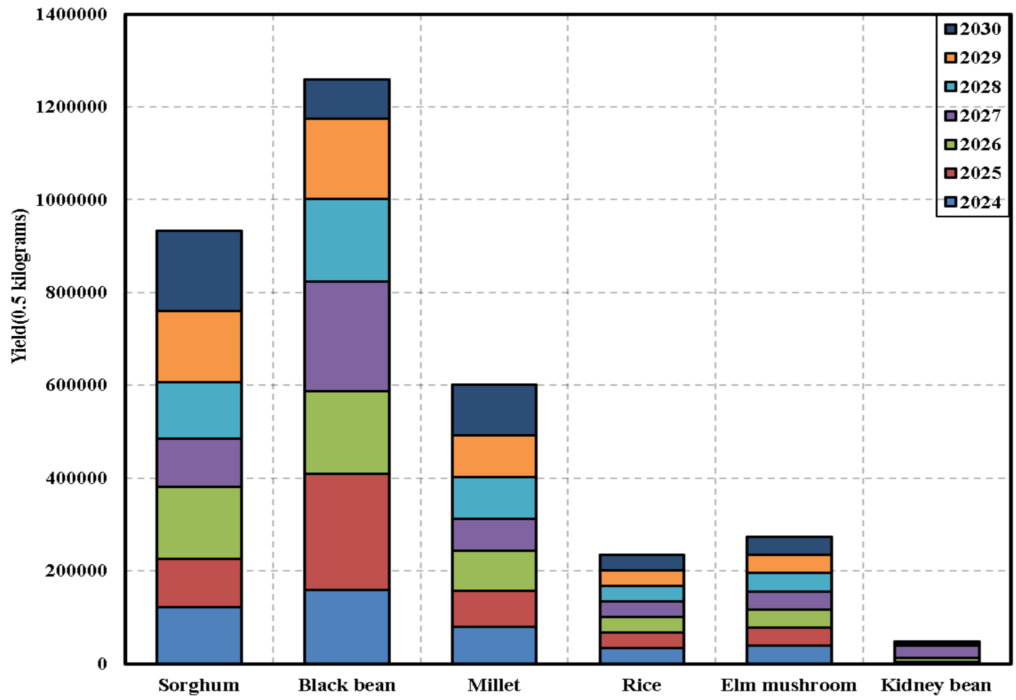

Figure 1. Data of unsalable crops in the next 7 years

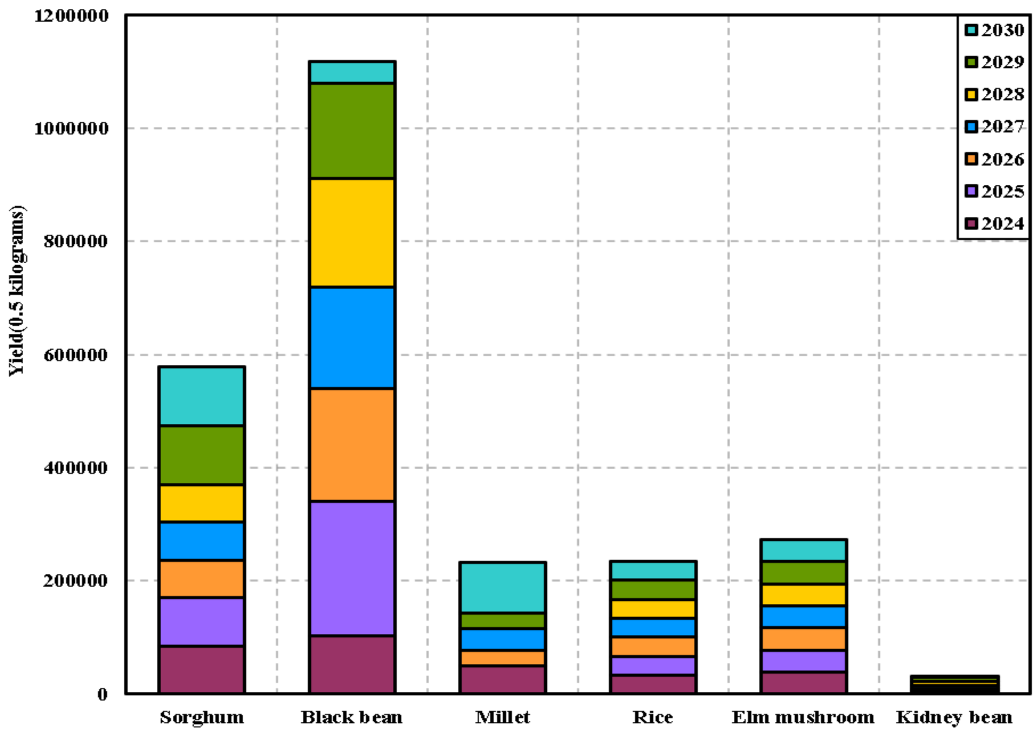

Figure 2. Data of crops sold at half price in the next seven years

Both Figures 1 and 2 are presented as stacked histograms. For the convenience of comparison, the same crops are selected. It is observed that the overproduction of Black bean is the most prominent, and other crops are also overproduced to varying degrees, and the relative overproduction is quite high in 2025. This may be due to the large deviation of market demand forecast, conservative planting planning, and insufficient sales channels. In addition, the change of market competition situation has blocked the circulation of products, which makes it difficult to sell the parts that exceed the expected sales volume smoothly, and finally leads to frequent overproduction.

4.2. Analysis of Planting Forecast under Risk Factors and Price Changes

The planting plan under the influence of uncertain factors is obtained by solving the mixed integer linear programming model. Table 3 shows the planting plan of some food crops under the influence of uncertainty during the period of 2024 to 2030, while Figure 3 shows the corresponding line chart of four profit trends, as follows:

Table 3. Some Planting Schemes under Uncertainties

Age	Plot name	Pumpkin	Plot name	Sweet potato
2024	A2	27.5	A1	40
2025	A3	17.5	A2	27.5
2026	B6	43	A4	36
2027	B14	10	B3	20
2028	C5	13.5	B9	25
2029	C6	10	B11	30
2030	C3	7.5	C4	9

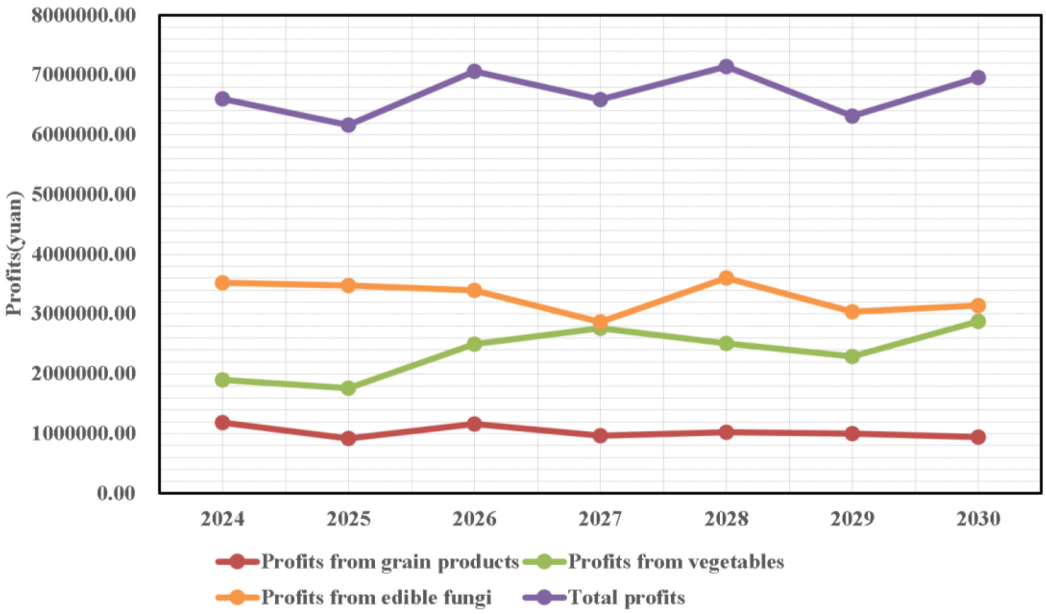

Figure 3. Four profit trends in the next seven years

As can be seen from the Figure 3, Profits from grain products is low and stable as a whole, with a slight decline, and it has always remained at around 10 million yuan. Profits from vegetables decreased from 2024 to 2025, and then gradually increased from 2025, reaching a peak in 2027, and then fluctuated, but the overall trend was upward, approaching 30 million yuan in 2030. Profits from edible fungi was relatively stable and increased slightly from 2024 to 2026, then decreased in 2027, reached the highest point in 2028, and then decreased, but remained at a high level in 2030. Total profits fluctuated greatly, but the overall trend was upward, reaching its peak in 2026 and 2028, and then declining, reaching 70 million yuan in 2030. These data reflect the impact of love under uncertain factors and planting risks. By optimizing the planting structure, it is still possible to achieve profit growth.

4.3. Analysis of Planting Prediction Based on Substitution Complementarity and Comparative Analysis

Using the integer programming model combining multi-stage decision making, the variable risk price planting scheme considering substitution and complementation is successfully obtained. According to the planting plan, we have further obtained the profit forecast data for each year of

2024-2030. This data is then integrated with the predicted data from other previous cases to draw the corresponding line chart, as shown in Figure 4 below:

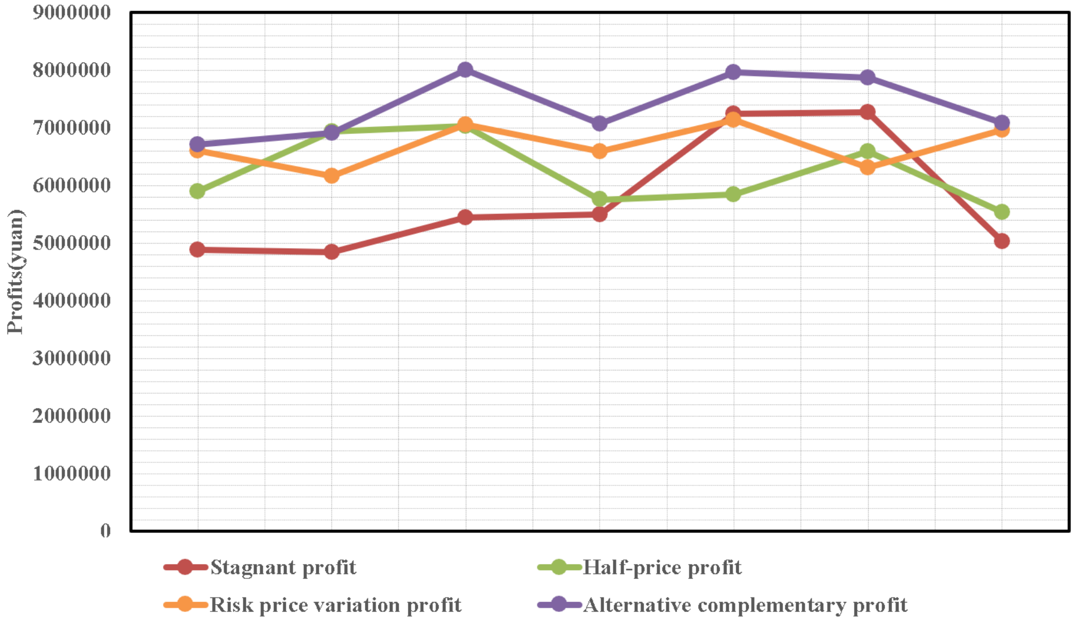

Figure 4. Profit forecast chart for the next seven years.

Upon scrutinizing the data depicted in Figure 4, after considering the substitution complementarity, the profit of each year has obviously increased compared with other situations, but it has obviously decreased in 2027, and it has also decreased under the condition of changing the price of risk. This shows that it may be that the planting area of complementary crops is unreasonable in the early stage, and the complementary advantages are not exerted when crops grow, but the competitive resources affect the output and profit. It can be seen that the synergy of various factors in planting planning is very important.

5. Conclusion

In this paper, a multi-objective optimization model based on linear programming is established. Under the conditions of slow sales and half price, the optimal planting scheme with the goal of maximizing benefits from 2024 to 2030 is studied. It is found that there has been frequent overproduction in the past seven years, and the total profits are 40.224 million yuan and 43.5892 million yuan respectively. Then the mixed integer linear programming model is used to study the optimal planting scheme after the actual risk and price change, and the total profit for 7 years is 46.8172 million yuan. The sensitivity analysis of 5% fluctuation of actual factors shows that the total profit is controlled within 8% fluctuation. The integer programming model based on multi-stage decision-making is used to analyze the optimal planting scheme considering the substitution complementarity of crops, and the final total profit is 51.6253 million yuan.

In view of the above conclusions, this paper puts forward the following policy suggestions: First, build a scientific planting planning and resource allocation system. Combine various factors to accurately plan planting area, pay attention to crop complementarity and dynamic adjustment, integrate cultivated land and optimize greenhouse utilization, and improve resource efficiency. Second, improve the market risk management mechanism. Professionally forecast and monitor the market, adjust strategies according to fluctuations, expand diversified sales channels, deepen cooperative development and deep processing, implement differentiated sales, and enhance market adaptability. Third, strengthen agricultural technical support and innovation. Increase investment in scientific research, develop applicable technologies, establish a demonstration training system, promote the transformation of achievements, cultivate new farmers, and help increase agricultural efficiency.

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