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STRATEGIC SIMULATION OF GROWING COMPETITIVE VARIETIES OF GRAPES

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Abstract

Within the framework of in-depth economic transformations in the Republic of Uzbekistan, the issue of modeling the production process is becoming more urgent. The current article provides a methodology for planning the definition of competitive - breeding varieties of grapes. For this, the methodology is developed taking into account regional factors of production and the experience of developed countries. The results of planning and forecasting will affect the further indicators of the production chain "forecasting - planning - growing - processing - realization".

Keywords: Planning, forecasting, modeling, assortment of grapes, competitive varieties of grapes

INTRODUCTION

Development of common strategy of actions for intersectoral production begins with identifying the key elements and benchmarks of business activities, which, combined with ideas motivation, defines main directions of the development of one or several interacting interdisciplinary productions.

In the system of grapes-wine industry, the problem is in organization and planning of strategic, economic, technological actions with single objective to ensure high-quality market products. For domestic market and export, it is necessary to improve existing system of planning and management of intersectoral production of these industries in the Republic of Uzbekistan.

In this article we pursued the goal of providing an economic - mathematical model for improving the process of planning and forecasting the future grape harvest, leading to the definition of competitive grape varieties.

LITERATURE REVIEW

As is well known, increasing production efficiency directly depends on the level of use of available material, financial and labour resources. These costs are turned into cost of wine products. In the product cost of wineries for processing of raw grapes, raw material costs account for the major share (90-95 per cent). Therefore, when searching for opportunities to increase production efficiency and its evaluation, particular attention should be paid to this circumstance.

In the grape-wine making complex, more effective spending of available resources finds expression in the production of more high quality, competitive products when the parties use relatively the same amount of resources. Therefore, one of the most important sources of increasing production efficiency is to ensure high quality of grape selective varieties.

Complex composition of grapes, availability of various ways of their processing, quality control of the finished products, give the possibility to predict the type and name of finished products, their properties, corresponding to quality and features of each grape variety. In order to simplify predicting, we have divided all grape varieties into V Groups. The division took place based on the quality of the wine, produced from given grape variety and its characteristics.

In special economic literature, there are three types of effectiveness

1. Technical effectiveness;
2. Economic effectiveness;
3. Social effectiveness.

METHODOLOGY

Planning process is based on the forecasting, by using data of previous years. In its turn forecasting and planning we use in order to define strategic goal of the enterprise. Most suitable method is using economic – mathematical method of putting task. We shall formalize this task, using the methods of linear programming.

For further modernization of the industry production, we believe appropriate to revise the current model of production process that consists of the following links in the chain: "forecasting-planning-growing-production-sales". The basis of the developed mathematical model is forecasting of grapes harvest, planning the future activities of grapes-wineries, identification of competitive grape varieties and production optimization. Application of this economic-mathematical model will maximize effectiveness of grape- wine production under market conditions.

At the initial stage, planning in grapes-wine industry is made on the basis of prediction estimations, especially it concerns seasonal period (August-October), when volume of harvested grapes is not known beforehand. We divided all varieties of grapes into five groups and work out forecasting on the basis of harvested area and amount of yield.

RESULTS AND DISCUSSION

The Republic of Uzbekistan is a country in Central Asia. This state is divided into 13 regions, each of which has its own characteristics in growing and processing grapes. The total area of vineyards in the Republic in 2016 was 131 thousand hectares. According to FAO, regarding cultivated area and volume of grape harvesting the Republic of Uzbekistan is included in 15 leading countries in the world.

Feature of Uzbek grape growing is that for each region it should be considered separately. Not everywhere, grapes grow in the same way, because there is difference in the region characteristics. Planting of grape varieties depends on the region ability and planting goals (Kasimov S.M. Sapaev D. Kh, 2018).

Grape assortment is presented by varieties of classic wine directions and new local grape varieties with group resistance to disease and increased resistance to abiotic factors- frosts and droughts (30–25%). If technical effectiveness embodies only technical connections of elements, allocated and included in the production, then economic effectiveness, in addition, embodies the price links (Grishin I.I, Panfilova E.E., 2005).

Let us take a look at some criteria, used for choosing the best project or new product (developed theoretically or applied in practice). For convenience of presentation, costs will be denoted by letter C, and results – by letter P.

A. V. Glichev (2001) offers to determine the quality of products (K_y) by dividing all target outputs (Q_y), during this product use, into the amount of economic costs (B_y) that conditioned these outputs:

$$K_y = \frac{Qy}{By} \qquad (1)$$

In this case $\begin{cases} C = By, \\ P = Qy, \end{cases}$

Academician T.S. Khachaturov (1989) gives general formula of effectiveness as-

$Ee = \frac{E}{I}$, (2)

Where, E-effect; I- costs

In the United States, method of cost-effectiveness is widely used.

Leading American specialists in the field of designing large systems G.H. Good and R.E. McCall (1962) offer to assess different variants of systems by comparing the amount of spent sum of money (C) with the unit value of achieved result.

Though all considered models differ in type and scope, they are united by comparison of costs (C) with obtained result (P).

As selection criteria for effective cultivation of competitive selective industrial grape varieties, we shall take the following expression:

$K = \frac{p}{Cc + Cp}$, (3)

Where, P- received net profit; Cc and Cp –costs, respectively, associated with cultivation (Cc) and processing of selective industrial grape varieties (Cp).

This criterion, taking into account all the specificities of grape-wine making complex along with the technological, economic, social factors of improving production efficiency, makes it possible to take into account natural biological factors.

The task of selecting for cultivation of effective selection varieties of grapes can be formulated as follows.

Let there be (i) amount of land plots, used for vineyards and «d_{jk}» -the number of harvest (j-x) of competitive industrial grape varieties, expected from these plots. We know the number of labor resources (T_{qt}), employed at each of the vineyards, as well as technical and economic characteristics of competitive selective industrial grape varieties. It is necessary to choose such selective grapes varieties (x_{jk}) for cultivation at each vineyard that allow achieving maximum accumulated profit in the production of wine products with the specified quality and taste

From available «j» selective varieties of grapes, it is necessary to choose such varieties, with which objective(target) function (F) reaches maximum.

$F = \sum_{j=1}^{m} \sum_{k=1}^{r} Pjk * xjk \rightarrow \max$, (4)

With the following limitations

1) for use of planting acreage

$\sum_{j=1}^{m} \frac{xjk}{djk} \leq S_k$, (k=1,¯r) , (5)

2) for use of labour resources

$\sum_{j=1}^{m}\sum_{k=1}^{r} Qgjk * xjk$ ≤ Tqt, (g=1,g¯), (t=1, t¯) , (6)

3) for use of funds

$\sum_{j=1}^{m}\sum_{k=1}^{r} ajk * xjk$ ≤ Dqt, (t=1, t¯) , (7)

4) for use of mineral fertilizers

$\sum_{j=1}^{m}\sum_{k=1}^{r} Vjk * xjk$ ≤ V_w, (w=1, w¯), (8)

5) for production volumes of wine products

$\sum_{j=1}^{m} xjk$≤ Hj, (j=1,¯m) , (9)

For non-negativity of the production volumes of wine products

$H_j^{min} \leq x_{jk} \leq H_j^{max}$, (10)

Where, k- serial number of the vineyard

j- selective grape variety

d_{jk}- yields of grapes of j selective variety at k vineyard

x_{jk} –the amount of grapes of j selective variety, grown on k land plot;

Q_{gtjk} –costs rate of g-type of labour at k-vineyard- that vineyard where grapes of j-selective variety is grown int-season;

S_k- planting area of k- vineyard;

V_{wjk}- costs rate of mineral fertilizers of cultivated grapes of w – type in cultivation of grapes of j-selective variety at k-vineyard;

P_{jk} –volume of profit, received from unit of cultivated grapes of j- selective variety at k- vineyard;

t – serial number of the wine season;

q- type of labor;

A_{tjk}- costs rate of funds for growing grape of j-selective variety in t-season at k-vineyard;

T_{qt} – the number of labor resources of q-type, available at the farm in t-season, when growing grapes;

D_t- the amount of funds of the farm in t-season;

W- type of mineral fertilizers;

V_w – the amount of mineral fertilizers of w-type;

H_j and H_j - the minimum and maximum allowed for growing volumes of grapes of j-selective variety.

Task solving (4-9) allows you to determine the most effective for cultivation selective industrial varieties.

However, solution of this task does not allow taking into account the final result, i.e. the result of selling wine products on the world market. In calculating costs and benefits of agricultural sector, internal price lists are used as basis of grapes prices .

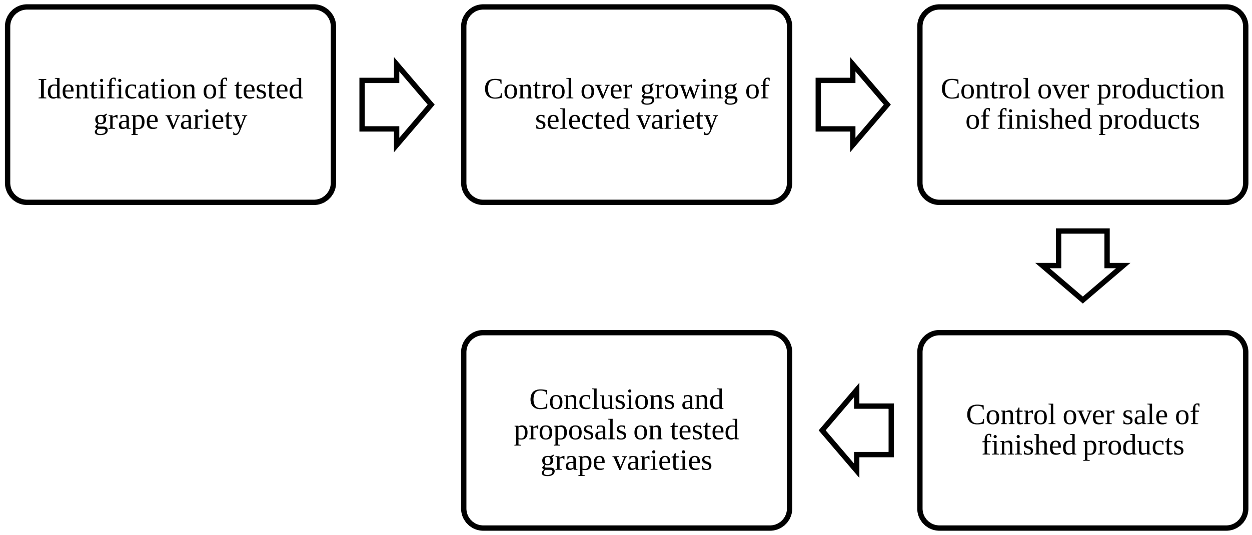

Figure 1 Planning and forecasting of cultivation of competitive industrial grape varieties

According to the given model, it is possible to produce competitive grape varieties. Competitive grape varieties mean those grape varieties from which wine, enjoying great market demand, is produced. At each stage of the model, certain tasks are set:

1. Identification of tested grape variety covers analysis of all planting acreage; analysis of cultivated varieties in the region of one or more selected varieties for further study.
2. Study of the factors, affecting efficient cultivation of technical grapes varieties;
3. The next stage is control over processing and finished product output. The goal is to study production process for efficient production.
4. The most important is the control over sale of the finished product. Here the main task is to determine supply and demand for manufactured finished products.
5. Based on the results, obtained after studies, decision on feasibility of further sowing of selected grape variety is taken.

In the system of forecasting and analytical calculations in grapes-wine industry, functional purpose of sectoral model is to harmonize economic and sectoral indicators at each stage of the production process. It is based on the stepwise calculation of key input-output balance tables (IOBT), based on data, submitted by accountable organizations. In our case this includes enterprises of agricultural industry, wine industry enterprises and trade organizations (7. Yani A.V, 2012).

On the basis of composed models of functioning of commodity complex sectors, output in the corresponding industry is formed. For the purposes of analysis of economic dynamics indicators of composed IOBT model, choice implies use of official state statistical information as a source of statistical calculation base.

The proposed model is based on three main phases, with their typical tasks:

1. Identification of wine, enjoying high demand in the market:
2. Definition of producer of wine products:
3. Determination of grape varieties and their supplier;

When forming and improving the model of functioning of grapes-wine industry members, emphasis should be placed on prediction calculations.

Taking into account direction of grapes use and quality of finished product, grape varieties are divided into five groups. The I group includes vine varieties, which predetermine high quality of finished product: Aleatico, Muscat pink, Hungarian Muscat, Pinot black and Tavkveri.

Group II includes: Kulja, Maisky black, Morastel, Risling, Rkatsiteli, Saperavi, Hindogny.

Group III includes: Soyaki, Parkent pink, Bakht.

IV- background varieties: Tarnau, Bishty, Bahtiori, Bayan Shirey.

V group includes mix of technical and table grape varieties: Rangdor, Nimrang, Taifi rose, Husayne, Oltinsay, etc. (https://www.vinsanoat.uz).

Prediction calculations are made based on iterative procedures by solving modified static IOBT model:

$x = (E\text{-}A)\text{-}1\ y,$ (11)

Where, x – gross output vector;

y – final demand vector;

E – identity matrix;

A – matrix of cost coefficients.

Forecast of receipt of quality grape by varieties

$\alpha_{ij} = \alpha_{1j} + \alpha_{2j} + \alpha_{3j} + \ldots..\alpha_{nj}$

α – indicator of the I group grapes assortment

i – the number of farms, growing wine grapes(i= 1, 2, … n)

j – grape variety

$\beta_{ij} = \beta_{1j} + \beta_{2j} + \beta_{3j} + \ldots..\beta_{nj}$

β - indicator of the II group grapes assortment

i – the number of farms, growing wine grapes(i= 1, 2, … n)

j – grape variety

$\rho_{ij} = \rho_{1j} + \rho_{2j} + \rho_{3j} + \ldots..\rho_{nj}$

ρ - indicator of the III group grapes assortment

i – the number of farms, growing wine grapes(i= 1, 2, … n) j – grape variety

$\sigma_{ij} = \sigma_{1j} + \sigma_{2j} + \sigma_{3j} + \ldots..\sigma_{nj}$

σ - indicator of the IV group grapes assortment

i – the number of farms, growing wine grapes(i= 1, 2, … n)

j – grape variety

$\tau_{ij} = \tau_{1j} + \tau_{2j} + \tau_{3j} + \ldots..\tau_{nj}$

τ - indicator of the V group grapes assortment

i – the number of farms, growing wine grapes(i= 1, 2, … n)

j – grape variety

We will receive total amount of wine grape varieties of all groups, grown in the region, according to the following formula:

Total amount of grapes, cultivated in the region

$V = \sum(\alpha+\beta+\rho+\sigma+\tau)_{ij}$ (12)

In total system of solving of complex of interrelated tasks when planning industry functioning, forecasting of raw materials volumes, one-factor and multi-factor regression models are applied. One-factor regression model is expressed in the following equation.

$y = f(x)$ (13)

Where: x- the variable, value of which is determined by the number of grapes, adopted for recycling;

y - dependent function that indicates the amount of produced wine material;

Next, we use the least squares method, where requirement of the best harmonization of theoretical and experimental dependencies points that the sum of squares of deviations of experimental points turned in minimum.

$Variable\ y$ is a function of argument x and parameters a, b, c.:

$y = f(a, b, c),$ where:

a - the number of grape varieties

b - the amount of grapes

c - group composition of grape varieties, consisting of 5 groups (I,II,III,IV,V)

Parameter values a, b, c perform the following condition:

$\sum_{k=1}^{m} [y_k - f(x_k; a, b, c \ldots)]^2$

Here k(k=1,2, …. m) – number of observations

Y_k - actual value of the dependent variable at point k;

$f(x_k; a, b, c, \ldots)$- estimated value of the variable at point x_i.

Then, multi-factor regression models take into account the impact of all parameters and factors on the dependent variable Y and, as a consequence, it becomes possible to predict the quality and range of finished products [9/96/3].

$y=a_0+\sum_{j=1}^{N} a_j x_j$ (14)

$j = 1, 2, 3 \ldots N$

Therefore, having the above information, one can form optimal high-quality range of wine products.

CONCLUSION

Production of competitive wine depends a lot on the quality and characteristics of the grape variety. Success also depends on proper planning implementation and forecasting of results at each stage of the production chain. Planning and forecasting of cultivation of competitive industrial grape varieties can be presented as the next model.

The experience of a number of practical predictive calculations shows that this construction increases the overall validity and interpretability of the final prediction results, facilitating long-term planning of the activities of the enterprise.

Article shows the development aimed at improving the process of planning and forecasting the future harvest of grapes, which leads to the definition of competitive grape varieties. Determination of competitive grape varieties contributes to the formulation of the development strategy of the wine industry. Analysis of the wine industry will be complete if there will be forecasting and planning of sales of final goods, using economic-mathematical model or econometric approach.

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