

PREFERENCE MANAGEMENT ACTIVITIES BASED ON GOOD AGRICULTURAL PRACTICES IN TOBACCO PRODUCTION

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Abstract

Modern management requires from professional and scientific workers in the field of biotechnical, natural and social sciences to contribute to the policy and strategy for improving the development of agricultural production through multidisciplinary approach. In this regard, it is particularly necessary to identify the priorities, limitations, problems and objectives related to the development of tobacco production. The concept of good agricultural practices (GAP) may give a special contribution to economically justified and good quality tobacco production. The average production of tobacco in the Republic of Macedonia in the last fifty years was 30,000 tons and application of GAP is of particular importance for its improvement. This concept has been developed in recent years as a result of rapid changes and globalization in agricultural production. The recommendations and information provided by GAP refer to the environment, economic and social security of production. The use of the widely accepted principles of GAP, general indicators and practical application help the national policy in preparation of strategies to ensure that all manufacturers, processors, consumers, merchants, etc. participate and use the benefits of its application. In this paper we present some principles of the GAP concept in tobacco production as well as the interdependence between tobacco production and tobacco growing areas.

Keywords: management-concept, behavior, tobacco production, agricultural strategy, good agricultural practices.

Introduction

In the Republic of Macedonia, tobacco is traditionally grown agricultural crop with high economic and social significance not only for the population engaged in its production but also for the whole country. Although no one denies the economic and social aspect of tobacco, nowadays there is a strong and loud anti-tobacco campaign on the harmful effects of tobacco smoke on human health as well as the risk of water pollution caused by leaching of nitrogen from the applied fertilizers and uncontrolled use of agrochemicals, as emphasized by environmental associations. This obliges us to participate in the raising public awareness for gradual redirection to high-quality tobacco varieties and to other crops, accepted by the EU (previously considered by appropriate scientific research and state institutions). Tobacco growers should develop proper management procedures based on good agricultural practices in order not only to enable high quality production of tobacco and other crops, but also to raise environmental concerns and continuous training of farmers for their activities, starting from breeding process and ending with sale of baled tobacco and all other activities related to the human factor. This paper emphasizes the need for the use of GAP in tobacco production, which would increase the average yield per hectare, as indicated by the impact of unidentified 46% of the impact factors according to the econometric model of correlation used in the study.

Results and discussion

Good agricultural practice (GAP)

The promotion, use and further development of tobacco production techniques and strategies that satisfy the requirements of buyers, the improvement of farmers' success, their continuous training and care for the environment are priorities for modern agricultural production. They can be defined as agricultural practices which contribute to the achievement of higher yields and quality, enabling at the same time the preservation and improvement of the environment, with special attention and care for soil, water and air pollution and survival and undisturbed development of flora and fauna. Nowadays, the attention is focused on farmers' skills to influence the production by applying appropriate methods and tools for achieving higher yields, with constant care for preservation of the environment. The system of measures and methods used in the processes of production should be adapted to the numerous sensitive environmental problems, genetic diversity, wild animals and their habitats, and, in some cases, to the social structure of agricultural communities.¹ Also, manufacturers must take into account the demands (preferences, taste, indications) of consumers all over the world, because today they are better informed and more critical than in the past and want to know how the products are grown and which materials are used during their production.

The key areas which should be targeted by management activities are the following:²

- Soil management and irrigation
- Integrity diversity / Selection
- Yield management
- Integrated pest management
- Agrochemicals management
- Forest management
- Management of proper manipulation and storage of tobacco
- Farmer's storage of tobacco
- Non- tobacco related material / foreign material
- Farmers training
- Socio-economic issues

The above mentioned management activities need to be continuously improved with new elements based on acquired scientific knowledge and good agricultural practices.

Management of soils and irrigation

The selected tobacco-producing system must be adaptable to specific situations. Land and water should be managed carefully, taking into account their physical, chemical and biological characteristics. Each specific situation requires adaptation of the previous practice of land and water management and adoption of new techniques. The control of land erosion can significantly reduce the possibilities of surface water and groundwater pollution and preserve the quality of land and its fertility. Therefore, land and water management is a key factor for efficient and environmentally sustainable tobacco production.

Land is natural, dynamic and sensitive resource.

When determining the selection criteria, the following items should be considered:³

¹ Drucker P. (2007). *Innovation and Entrepreneurship*, Foreword by Christopher Bones

² <http://www.fao.org/docrep/013/i1645e/i1645e00.pdf>

³ Porter, E. M. (1985). *Competitive Advantage: Creating and sustaining superior performance*, New York: Free Press, London

- Soil type, depth and fertility
- Slope of the land
- History of crop rotation
- Drainage
- Tobacco cultivation on a steep land, unless it is terraced, should be avoided; such areas could be more convenient for growing fruit trees
- It is necessary to apply contour planting of tobacco and to adopt new experiences and techniques, such as terraced farming, and linear planting, which are used to prevent erosion, help vertical water infiltration and retention of land, reduce land movement and erosion, etc.
- Cover crops are cultivated to protect and improve the soil without intention of harvesting. Land should be planted (covered) as long as possible with living plants (herbs) or crop residues, in order to prevent erosion losses and the harmful effects of extreme temperatures. Where feasible, soil should be covered with straw and, if possible, minimum or no ploughing should be applied.

Water Management

Water is natural resource of limited quantities and its maintenance is of particular importance for plants, animals and humans.

- It is not allowed to apply or mix the agrochemicals near water sources
- Fertilizers or agrochemicals must not be poured into water sources
- It is necessary to protect water sources for irrigation
- Avoid irrational consumption and use of water
- Prevent the contamination of water sources by the water-fertilizer mixture used in the seed plots or other plantations
- Water pollution (with fertilizers, agrochemicals, fossil fuels, oils, etc.) must be reduced to a minimum

Avoid the following:

- Agricultural chemicals and fertilizers which are very likely to leach
- Excessive use of agrochemicals and fertilizers
- Re-using irrigation water

It is recommended to make protective belts between arable land and environmentally sensitive areas. Strategically placed protective belts can effectively reduce the leaching of sediments, nutrients and agrochemicals inside and outside arable land. Protective belts allow the farmers to achieve a significant degree of economic and environmental delicacy in their operations, increasing the habitats for the wildlife and protecting the diversity of species. Farmers should moderately use chemicals to protect plants from various diseases and pests. After their use, the chemicals from plants and soils are washed by precipitations and the unclean water with toxic chemicals is carried to rivers, lakes and seas. This way they destroy the aquatic animals but they also contaminate the soil and the aquifers. It is neither good for the coasts visited by tourists (river, lake and sea beaches). Man can contaminate the groundwaters by making stables for domestic cattle or throwing the garbage near the sources of drinking water. Water is an integral part of human life but it is the most sensitive to pollution and all efforts should be made to protect it from contamination. The same is also valid for the air: the human health depends on clean air, which contains more oxygen.

Diversity of integration and selection

The diversity of integration and selection is the basis for successful harvest in terms of agricultural and environmental quality and it provides good economic perspective.

Guiding principles and methods:

- Methods and procedures should be established for the accepted species to test their agronomic (agricultural) convenience and market acceptability

- Certification and seed production programs should guarantee genetic purity of various types of tobacco
- Only certified, registered or approved species can be grown, the origin of which can be checked in accordance with the rights of the producers of new species (seeds), protection of the species and other intellectual property rights
- Only certified, registered or recommended species resistant to certain types of diseases typical for the area and in accordance with the needs of the market can be grown
- For conventional use only conventionally developed and cultivated species can be planted
- Practical measures of bio-protection and the preservation of product identity must be strictly enforced to prevent interference with GM (genetically modified) products.

Production Management (Crop/Harvest Management)

Production management denotes the establishment of a framework (with rules and procedures) for tobacco production which requires agricultural and ecologically acceptable good practice starting from planning of the production to post-harvest activities in order to obtain the requested type of tobacco and expected shape of the leaf.

Guiding principles and methods

- Tobacco seedling should be :
 - produced in environmentally friendly system, without use of harmful fumigants such as methyl bromide
 - from certified seed of registered and recommended species
 - uniform
 - healthy and resistant
- In treatment and preparation of soil, care should be taken to the following:
 - make as few environmental disorders as possible
 - maintain the fertility and soil structure
 - apply crop rotation and soil conservation, increase the fertility and minimize the erosion
 - weed control, improvement of the process of growing and productivity of tobacco
- Fertilization should be:
 - adapted to the nutrition status of soil, crop requirements and local conditions
 - applied at the right time and in agreement with owners of the private plantations
 - performed with fertilizers that are approved and recommended for tobacco
 - agrochemicals should be used only when really necessary and in accordance with IPM (see IPM Section)
- Optimization of the production per unit area shall be obtained by:
 - adjustment to the most productive and most resistant practice suitable for each type of tobacco and local conditions, keeping the required quality
 - achieving uniformity and complete compatibility
 - minimizing losses in production due to physical damage to the leaf, overmaturation or excessive coloration (of leaves)
- Harvest, protection and preparation for the market:
 - harvest should take place at optimum time for each tobacco priming (hand)
 - protection should be carried out in most appropriate manner to obtain optimum quality
 - leaves should be sorted according to their size
 - bales must not be pressed too strong
 - tobacco should be stored correctly, in accordance with recommended conditions, in order to keep its quality
 - local research for further development of the concepts and details of GAP based on the acquired knowledge on local development as a feedback between local practical experience and innovation.

Integrated pest management

Integrated Pest Management (IPM) is systematic approach to crop protection that uses relevant information to improve protection decisions, with emphasis on integrity of the methods used. IPM does not mean complete elimination of agrochemicals but their adequate application as a defense from pests and diseases, which producers cannot maintain to an acceptable level using alternative measures. The application of agrochemicals should be safe for the product and in accordance with legal regulations.

Guiding principles and methods

- Fundamentals of the Integrated Pest Management:
 - rotation of tobacco with other crops that reduce tobacco pests and ensure a pest-free period for tobacco
 - providing constant yields for all crops; supplying necessary information on the history of the planted areas, soil analysis, pest species, weed and diseases
 - survey and inspection of areas to be planted with tobacco in relation to the possible occurrence of diseases, weed problems, experiences from the previous production and data on yields of the crops grown before tobacco
 - sampling of soil and roots from plants to determine the presence of nematodes
 - use of approved resistant tobacco species
 - use of certified seed that is not infected by disease causing agents
 - use of seedlings free of diseases or pests, uniform and healthy
 - planting at a time that is least suitable for development of pests
 - use of traps for protection from animals that could destroy tobacco
 - promoting the multiplication of natural enemies of pests and destroying alternative parasite areas
 - avoiding possible transmission of infection from tobacco products, waste tobacco materials or infected land by maintaining good hygiene in the period of planting as well as in the early stages of plant development
 - profound cleaning of the tools and instruments used for planting
 - destroying the remaining seedlings and residues of tobacco at the end of production cycles as soon as possible
 - destroying all waste from tobacco at the end of each production cycle

Management of agrochemicals

Management of agrochemicals encompasses a large sphere of activities, including the following:⁴

- agrochemicals should be used only when absolutely necessary and in accordance with IPM (Integrated Pest Management);
- *use only of those agrochemicals* registered and *approved for* the particular tobacco type
- follow all instructions and warnings labeled on the agrochemicals
- using personal protective equipment (PPE) during handling, mixing and application of agrochemicals
- using methods to ensure safety of people, animals and the environment in general
- regular rotation of tobacco with cereal plants in the interval between the harvests (keeping the principle: tobacco - cereal plants - tobacco)
- caution about the negative effect of agrochemicals residues on the use value of the harvest (yield)
- proper storage of agrochemicals, i.e. proper stock management of agrochemicals
- proper removing and deposition of agrochemicals and their residues (sediments) in the package or in the sprayer

⁴ Stošić, B. (2007). Menadžment inovacija - Ekspertni Sistemi, Modeli i Metodi. Beograd, FON

- relevant legislation (legal regulations) in case of hazardous use of agrochemicals, protection of the users against safety risks at work, i.e. legally regulated protection in the use of agrochemicals, instructions in the case of accident and acting in accordance with them, monitoring the health of the users of protective chemicals and the living organisms around them and regulations on the hazardous chemicals storage
- prohibition of eating, drinking and smoking while preparing and performing the agrochemicals protection
- prohibition of mixing or dissolving agrochemicals in the vicinity of water (rivers, wells, fountains, etc.). Sprayer must not be directed toward water or plants in the vicinity while treating with agrochemicals

Agrochemicals selection management

Special attention should be given to the selection of agrochemicals. Their choice should be based on the purpose of use, the manner and place of use. When selecting the agrochemicals, the most important is:⁵

- to select certified product with lowest toxicity and shortest decomposition period, safe for humans, wild animals and environment in general and at the same time efficient in the control of pests, weeds and diseases
- to apply selected chemicals adequate for each situation and not harmful to predators that feed on dead pests and/or residues;

The way of storing agrochemicals is a very important factor for safety not only of agrochemicals but also of people, animal and plant life and environment in general. Therefore, the users of agrochemicals should pay high attention to the following:

- each user is obliged to own and use adequate personal protective equipment;
- agrochemicals stocks should be stored in suitable place designated only for this purpose, well protected, packed (wrapped) in adequate materials;
- warehouses for storing the agrochemicals should be away from water sources (away from ponds, streams and drinking water wells);
- all agrochemical stocks should be stored in accordance with the requirements for safe storage of materials, clearly marked on a panel and labeled with basic storage instructions. Proper handling of the stocks includes: good arrangement of agrochemicals and easy access to all of them, good visibility, maximum safety with regulated temperature and humidity, isolation of agrochemicals with special anti-corrosive substances;
- identification of all flammable materials (by name) and their separation from other products, with clear identification of all hazards, specific precautions, instructions on how to react in the case of danger inside and outside;
- safe storage of stocks, i.e. their arrangement in appropriate order, with a distance between the lines, out of the reach of unskilled persons, especially children, and also protected from the reach of wild animals. In order to prevent people from touching the agrochemicals and to avoid accidents, labels and warning sign for the toxic effects of agrochemicals are required;
- providing a stable construction resistant to water, snow and other atmospheric disorders (storm, wind, hail, etc.), secured floor and walls
- impermeability of floors and walls against possible spread of agrochemicals and their uncontrolled leakage and contamination of water sources;
- use of adequate washing agents on the floors sprayed with agrochemicals or washing the containers (e.g. bins) used for dissolving agrochemicals and spraying of the crops. Proper removal of agrochemical residues in special secured places, inaccessible to animals and children;

⁵ OECD, Eurostat. Oslo Manual - Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition

- storage of agrochemicals in original packages with original factory labels. After use, package should be tightly closed and returned to the appropriate safe place;
- agrochemicals should be kept away from flammable materials and the the risk of fire;
- securing good accessibility to all agrochemicals in case of necessary action or unpredictable situations during spraying, falling, dispersing, fire or flood in the room where agrochemicals are stored;
- maintenance of stocks, with visible labels providing instructions on how to handle and store the *chemical*;
- keeping minimum reserves of the most necessary agrochemicals;

Tobacco production and its correlation with planted areas

Tobacco production in the Republic of Macedonia in the last seventy years ranges about 25,000 tons, i.e. 12,5 kg per inhabitant.

The highest production was reached in 1986 (35,020 t) and the lowest in 1961 (8,040 t).

The average production of tobacco per hectare is gradually increasing. Thus, compared to the 1084 kg/ha in the last seventy years, it has grown to 1,281 kg/ha in the last thirty years and 1,394 kg / ha in the last ten years.

Data on tobacco production and planted areas over the past thirty years are presented in Table 1 and Fig. 1.

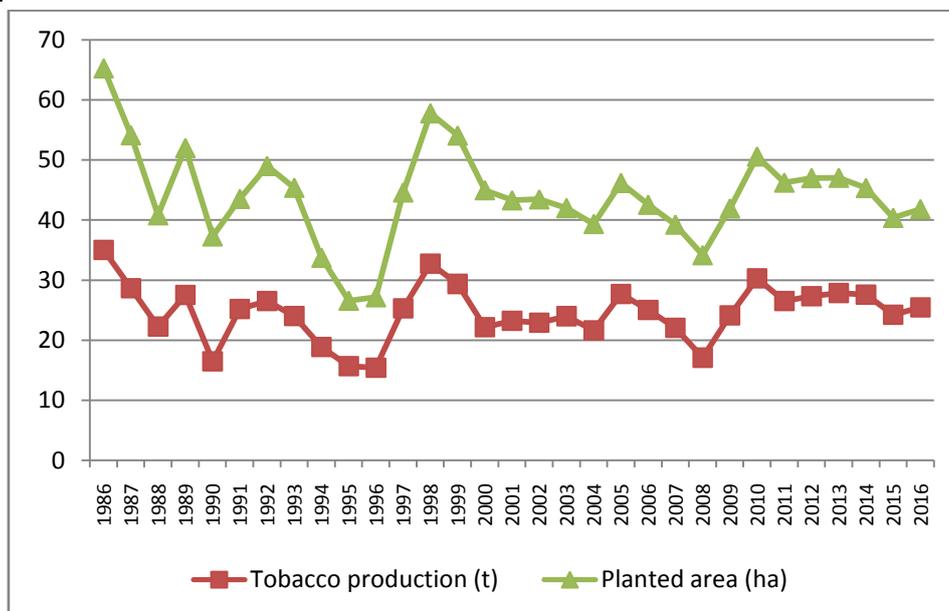


Figure 1. Tobacco production in the Republic of Macedonia, 1986-2016

The coefficient of correlation between tobacco production and area planted with tobacco was 0.733 high (calculated by the formula $Y = \beta_1 + \beta_2 X_1 + \epsilon_1$), whereas the coefficient of determination was 54%. This means that tobacco production is determined by the planted tobacco hectares with 54%, while the remaining 46% are determined by other factors, among which is the impact of good agricultural practices (GAP).

Table 1. Tobacco production in the Republic of Macedonia², 1986-2016

Year	<i>Tobacco production (in tons)</i>	Planted area, in hectares
1986	35.020	30.216
1987	28.648	25.465
1988	22.259	18.534
1989	27.537	24.456
1990	16.452	20.825
1991	25.195	18.324
1992	26.502	22.497
1993	24.002	21.373
1994	18.862	14.864
1995	15.683	10.891
1996	15.412	11.738
1997	25.308	19.290
1998	32.746	25.016
1999	29.368	24.700
2000	22.175	22.790
2001	23.217	20.067
2002	22.911	20.530
2003	23.986	18.008
2004	21.630	17.715
2005	27.691	18.485
2006	25.036	17.507
2007	22.056	17.183
2008	17.087	17.064
2009	24.122	17.809
2010	30.280	20.300
2011	26.537	19.693
2012	27.333	19.656
2013	27.859	19.178
2014	27.578	17.758
2015	24.237	16.126
2016	25.443	16.373
31	762.172	604.429

Farmers Training

Training on the farm (field) is one of the most important elements of each GAP program. It gives opportunity to the farmers to update their knowledge with the latest technological achievements and advantages and points out to the significance of GAP. Farmers' training is carried out throughout the world and various methods and techniques are used for this purpose. Farmers are included in GAP trainings organized by agriculture companies, industrial groups, institutions and universities, government agencies and private consultants. Farmers' trainings include frequent individual visits, group meetings, days spent in the field, radio and TV advertisements, printed brochures and posters, and other educational devices.

Guiding principles and methods:

- to provide continuous training and education in all GAP elements so that each participant is aware of its importance
- to treat the following issues: industry expectations, safe working conditions, prevention of the use of child labour, proper handling of agrochemicals, application, care and storage management, distribution, integration of diversities, land and water management, crop management, IPM, NTRM, forestry, handling of tobacco on the farm, classification and storage.
- to include formal training plans for all employees, contractors and farmers
- to organize initial training/education sessions in each area, followed by new courses each season in appropriate period
- to organize group meetings using visual techniques (posters), maps and multimedia, as well as practical group demonstrations as an integral part of the individual visits to farmers.
- to keep records of the courses and visitors (certified by signature of the instructor and the coach)
- to comprise guidelines, recommendations, manuals etc. which are in compliance with good management and guiding principles of GAP
- to cover the relevant legislation, dangers and risks from the application of agrochemicals, safe working methods, necessary actions, health control, etc.
- to introduce integrated pest management plans in order to reduce the use of agrochemicals

Conclusions

In today's modern economy, including tobacco production as its constituent part, no progress can be imagined without the application of management activities based on good agricultural practices. Tobacco industry encompasses a long chain of interconnected subjects such as farmers (tobacco growers), people employed in all tobacco producing organizations, traders (purchasers) of leaf tobacco, manufacturers and other subjects related to the basic industry. They all have a special role to promote the tobacco business through preference of proper management activities in all operations and processes of production, treatment and processing of tobacco. Tobacco is grown in many different regions of the world under different agrarian systems and levels of development. For that reason, there is no single pattern which would strictly state the activities of the agribusiness management, with special reference to tobacco production as a basic activity. It is necessary to apply correct management activities based on the principles of good agricultural practices, which would represent a common model, highly flexible and adaptable to different socio-economic and farming conditions of the regions or countries. This model will emphasize the principles that will be adapted and modified to specific farming situations, as well as their continuous improvement for production of good quality tobacco, with simultaneous concern for preservation of the environment. Thus, if certain unification still exists, it consists of constant adaptation and improvement of management activities in different fields and processes of tobacco production.

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