The Importance of Land Systematization for the Achievement of Highly Productive Agricultural Exploitations

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Key words: land management, plan content, efficient exploiting.

SUMMARY

The harmonious development of all natural areas, of counties, villages and other units are closely connected with the land systematization system.

The use of land resources as our main possession as well as the future generations' own represents a major priority in the process of land systematization. This requires the need to rationally manage the landed resources in accordance with economic necessities.

All this can be achieved through protection and improvement, making requests and resources agree, along development strategies and various stipulations of land planning national programmes.

Our country's agricultural policy for agricultural lands must ensure the following:
- The setting up of territorial and management conditions for an efficient use of agricultural equipment, of land improvement and water management;
- In the process of land systematization, the concrete natural and economic conditions of counties, natural-economic areas and of each and every village will be taken into account;
- Production and management must be performed on a modern basis.

Among the major objectives of Romania's agricultural policy we have got the rational utilization of the landed fund. Because after 1989, through the application of Law 18/1991, agricultural areas were scattered, now there is an action of setting up viable and productive agricultural exploitations through land-and- capital concentration from today's excessively small peasant properties. Both the agricultural production and the level of exploitations development depend on the degree of intensity in land use.

Land systematization and management represent the only way of coordinating spatial elements with the desired development, land use optimization in accordance with society's present and future demands as well as the basis for future investment development.

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1. INTRODUCTION

For larger agricultural units, the main condition for getting a higher production is to manage the land properly by introducing crop rotation. In this way we create the spatial-territorial conditions for better using all production resources.

The applying of all plans for land management and use of rational crop rotation in the larger agricultural farms is the first thing to do in order to create favorable conditions for a better production, to develop all its branches, to improve soil fertility and to increase overall production.

Land management and crop rotation are based on up-to-date topographic surveys, on agro-pedological and detailed soil surveys, on land melioration and economic evaluations.
Agricultural land management turns to good account, arranges, rehabilitates and evaluates all agricultural lands. The rational use of the land under extreme variables in climate, relief, hydrological pattern and soil texture is the effect of land management actions performed with a view to accommodating natural conditions with social-economic requirements.

2. THE NECESSARY ELEMENTS FOR LAND MANAGEMENT IN AGRICULTURAL UNITS

Before drawing up the plan for production and land management in an agricultural unit, we find the topographic surveys, the land survey book on destination categories and properties and the information with the economical and crop results evaluation for recent years. Unit land configuration, its relief and soils, level of technologies employed and future developments, as well, are being analyzed.

The present soil mappings are studied in order to find out their age, the quality and precision by the surveying engineers from the project team. Soil maps and agro-pedological aide-memoire are made up or they got it from the Research Institute for Pedology and Agro-Chemistry or from Pedological and Agro-Chemical regional offices.

Topographic surveys must show up: the relief, the borders of the agricultural unit, the limits of destination categories and the whole road network and other planimetric details. The plan scale is done on areas: 1/5,000 for rugged lands and 1/10,000 for plains, without big planimetric details. Relief representation for sloppy lands is compulsory on maps.

The actual position of animal farms, of summer camps or of other fixed funds is a must. On soil maps we draw the groups of homogenous ecological lands (HEL) which require special

measurements for soil fertility and separate crop rotation. On the soil map there will be a cartogram with erosion degree limits.
Climatic and agrometeorologic conditions are also studied, namely in the area where the agricultural unit under study is placed.

In order to interpret the organization and the economy of this production unit, we also interpret the reports and the accounts and balance sheets for the last 3-5 years.
After finding out the data from the design institutes and from the reports of the unit with a view to filling in and settling down the unit land resources, we may see them at work concretely.

The confrontation of topographic plans with the situation in the field is strictly compulsory because from the soil survey up to the land management there always appear disagreements the plan being unchanged while the land is permanently changing under the influence of natural factors, of production and melioration activities. When the changes on the whole surface of the unit is more than 30% of the entire surface, it is necessary to get a new topographic survey or a photogrammetric one. It is necessary to acknowledge and rectify the borders of the unit and its purpose is to eliminate dispersed lands which will allow a better inner management of the land.

2.1 Land Agro-Meliorating Study

This type of research in the field intends to recommend for each plot of land the right destination, melioration works meant to rise productivity or necessary for the changes, grouping of plots in massives of ecological lands for crop rotation on the basis of documents, long-term observations and field research.
Based on studies, of documents and of field agro-melioration research, the administrations together with the project team draw the conclusions for unit land management.

3. LAND MANAGEMENT PLANS CONTENT

Agricultural unit land management is achieved by projects made in accordance with land and city planning stipulations as well as with agricultural production mapping. In agricultural land management, the leading principle is the mutual relation between all components, land elements management and indicators for a future development.
Agricultural unit land management must support:

- The turning to good account of all landed resources through a correlated extension between land management, land rehabilitation and water planning,
- The positioning and calibration of use categories in order to ensure the increase of superior use categories so that each form of relief, each land category should be used for maximum crops with minimum expense.
- The creation of special areas for the development of various industries, the profiling, concentration and specialization of agricultural production with an emphasis on the economic correlation between landed resources, the natural background and the applied technologies.

- The establishment of a rational system of land usage and of higher soil suitability.
- The creation of prerequisites for better working and technological conditions for optimum cropping and agricultural activities.
- The creation of viable and efficient units for the optimum use of natural and human resources.
- The unitary and integrated development of animal breeding, fruit growing, viticulture, vegetable growing – according to national and local program strategies, taking into account the specific characteristics of each unit.

All these aspects are to be found and thoroughly defined in the 18/1991 Law of the Land Resources, under the new conditions of so diverse forms of property.
In order to develop various processes on the landed areas of the great agricultural units with so many types of relief, soils and waters, a development program is under way through a land management project.

This project is issued keeping in mind the very development program of the agricultural unit, taking into account the concrete natural and economic conditions of the unit.
This management program includes all the land, also the one under lease. This project is issued by the Council with the help of the specialists in design from design institutes.
Both the land management plans and of the agricultural unit production are done in a given succession of its components, as follows:
1. The establishment of animal and vegetal production sub-units size and delimitation with production centre location. For present plantations, the first thing to do is to draw out the borders along natural or artificial lines with compact- shaped units and sub-units.
Compactness of all plots around production centers will eliminate huge transport expenses and useless trips and will help inner organization.
2. The establishment and setting up of their destination the introduction of crop rotation on the arable land.
The activity of agricultural units largely depends upon the rational and intensive use of all land categories and their type of usage, after stable characteristic such as: relief, soil, hydrography, the microclimate of various unit areas, so that by managing the land of agricultural units, a change in their destinations occurs by increasing the cultivated areas.
3. Crop rotation area management.
Within the crop rotation massive area, we must create regional conditions for using high-efficiency agricultural machines, the stopping up of erosion processes, and the introduction of a scientifically based agrotechnical system fit for soil quality and for work rational management.
4. The management of vineyard and tree plantation lands.
In agricultural units from favorable areas which have as perspective plans investments in tree plantations or vineyards or even the extension and modernization of present plantations, a management design is done once with the unit general management. As for the plantation area management, plots with various varieties, a road network and water supply sources will be taken care of.
5. Management of pasture areas

In the hilly regions, pastures and hay fields represent about 20- 40% from all unit agricultural surface. They represent the most important source of green fodder and hay. If we want to breed animals by feeding them with green fodder from pastures and protect soils from erosion, pastures must be managed properly and rehabilitated through soil melioration and fertilization.
Of all five actions the most important are: structure setting up, destination planning, crop rotation and their inner management. The others are important according to specific areas, while the setting up of destination structure and crop rotation are done in all units, without exception.

4. LAND MANAGEMENT AND PLANNING FOR ARABLE LAND TYPE

Arable land management represents a managerial technical activity by which the main types of crop rotation, their number, the position and dimensions of working units are being established.

4.1 Crop Rotation Management

Land management and crop rotation within agricultural units represents a complex technofields- economical activity and it aims at ensuring optimum conditions for land resources exploitation, production concentration and specialization, the efficient exploitation of land and of their technical facilities. By exploiting the various crop rotation systems we want to ensure a rational use of arable lands according to their productive potential. This aspect is important for those units having various forms of relief, where we may achieve field crop rotation for fodder or we may set up vine-fruit growing plantations.

The arable land is ordinarily used for culture rotation, by avoiding monocultures which lead to: soil exhaustion, soil fertility decrease in general and in some nutrients, the increase of the number of specific diseases and pests for each culture, surface and depth water reserve exhaustion.

The cumulative effect of rotation is the increase of agricultural production without extra expenses.
The rational crop rotation cannot be achieved on small surfaces, in small exploitations. A rational rotation for field plant culture in the plain region is organized on at least 4 cultures, each on surfaces of 10-100 ha. The researches of the Academy of Agricultural and Forest Sciences have estimated for a plain region a minimum of 50-100 ha for cereal and technical plants culture.

The actual dimensions of peasant exploitations are about 2.5 ha, of simple agricultural societies of about 115 ha, while for agricultural associations – 450 ha.

The crop rotation includes the operation of surface division owned by the exploitations in the field and the achievement of rotation in space and time, in order to achieve the suitability of various cultures as preliminary plants.

In agricultural practice we know a series of crop rotation types which are going to be presented here.
1. Field agricultural crop rotation is applied in case of field cultures (cereals and technical plants), meant for human, animal and for rough materials processing industry. It occupies the largest surface of agricultural units and it comprises plain areas, plateaus and light slopes areas without erosion or humidity excess. If determined by the proportion of a culture or a group of cultures we may distinguish specialized crop rotation for maize, wheat, sugar beet, soy, etc.
2. Fodder crop rotation is meant for fodder cultures in the quantity and type imposed by animal species and breeding techniques. Fodder crop rotation may be of various types: pasture and hay fields, quite close to the farms used primarily for grazing and fodder production or hay and, on the other hand , farm crop rotation occupied with plants cultivated for producing succulents as green mass and silo with great transport volume. We must place these crop rotation systems quite close to animal farms, on fertile lands, with good irrigation and humidity conditions.
3. Mixed crop rotation represents cultures or groups of cultures made up of two or more categories. They are: agricultural crop rotation, fodder, fodder-agricultural, fodder-vegetable and complex (mixed).
4. Special crop rotation is determined by some land characteristics or by culture types. They are: for protecting against slope erosion, against eolian erosion on sands, of protection on salty lands or, according to types of culture there are: vegetable, rice, etc.

5. SIZING AND LOCATION OF WORKING UNITS ON THE ARABLE

The main working units on the arable are the field, in general, and its subdivision, the plot, in particular.

In determining the optimum dimensions of fields and plots, the major role is played by the agricultural mechanization of all activities and transportation, which are more expensive than other activities. Plot delimitation is done according to land relief, natural limits (forests, rivers, etc), the technical improvements of the area (railways, roads, dykes, irrigation canals and draining), the built up perimeter areas of towns, production centre placement, etc.

5.1 Field or Plot Shape

The shape recommended for territorial units and working areas is a polygon with two parallel sides – the long ones must be parallel, while the short ones must not be necessarily parallel (figure 1).

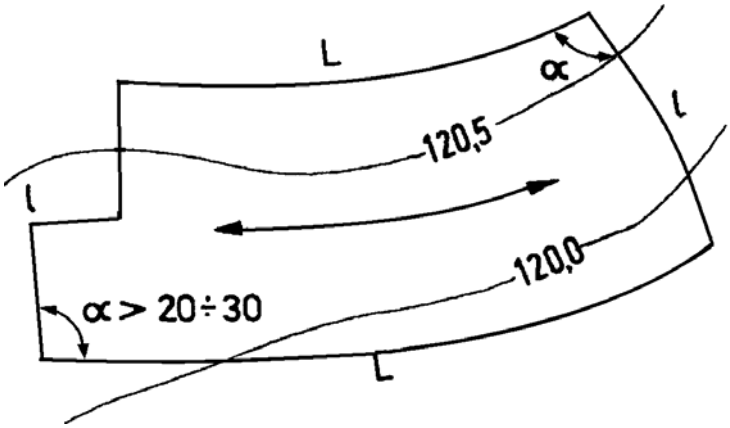

Fig.1 – Optimum shape of a plot or field

The optimum shapes may be rectangle, parallelogram, trapezium, square.
The shape of plots and fields must not lead to the appearance of triangular surfaces during agricultural works.

Triangular shapes are not accepted, but if they appear due to relief forms, being imposed by natural relief, we must limit them, divided into plots so as to create parallel sides on the directions of agricultural processing. The angles between the big sides and the small ones must not be under 20-30 ˚ (a >20-30˚0 to avoid useless movements for machines.

5.2 Plot or Field Dimensions

The dimensions are determined by the two sides (L, l) and by the working units surface (S). The active trip time on the long side, passive on the short one (on their way back), as well as the production expenses per ha, led to the following optimum dimensions:
L= 800-1200 (1500) m, going down up to 400 m for slope lands;
L= (1/2 -1/3) x L, reaching (1/4 – 1/6) x L, for rugged lands and with slopes >5%.
The optimum dimensions of plots have a positive influence upon the smaller percentage of plants destroyed on the back way alignment (I) and by reducing expenses for transportation from and to plots or fields.

5.3 Plot and Field Arrangement according to Forms of Relief

On light -sloped lands (I<5%) the risk of erosion is very low, the placement of plots is not strictly connected with the leveling curves , but with the road network, forms of relief, usage categories and other obstacles or natural limits (Fig.4), without being forced to place plots parallel to the level curves and in this case, parallelism is required.

On medium –sloped zones (I=5-12 %) the working units will be placed with its long side parallel to the level curves, accepting a deviation of 2-5%). A working unit placing model on uniform or rugged slopes is shown in figure 2.

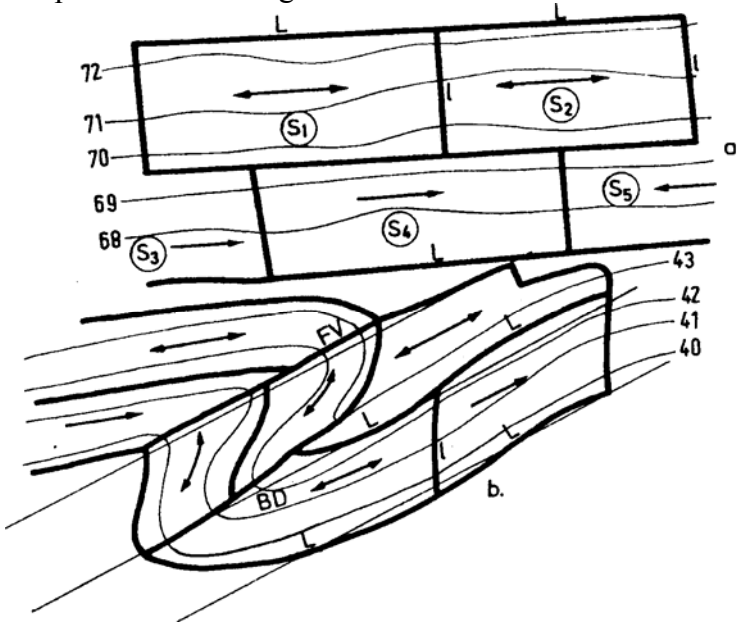

Fig. 2 – The arrangement of plots on slopes:
a- uniform relief: b- rugged relief

The soil quality also influences the arrangement of plots or fields through its degree of fertility, its physical, chemical, hydro physical, texture and structure which ask for special agrotechniques – such as the sowing time, the vegetation time, technological maturity, etc. Soil homogeneity can be easily achieved in plains and much more difficult in hilly or plateau regions, where soils are very heterogeneous and where primarily remain the relief, for plot dimensioning and position.

5.4 Plot and Field Placement as to the Village and the Production Centers

Plot position as to the village and the production centers is given by the necessity to have shorter transportation trips to the village. There are radial, linear and mixed placements. The radial is required by massed- in land surfaces around the villages (figure 3).

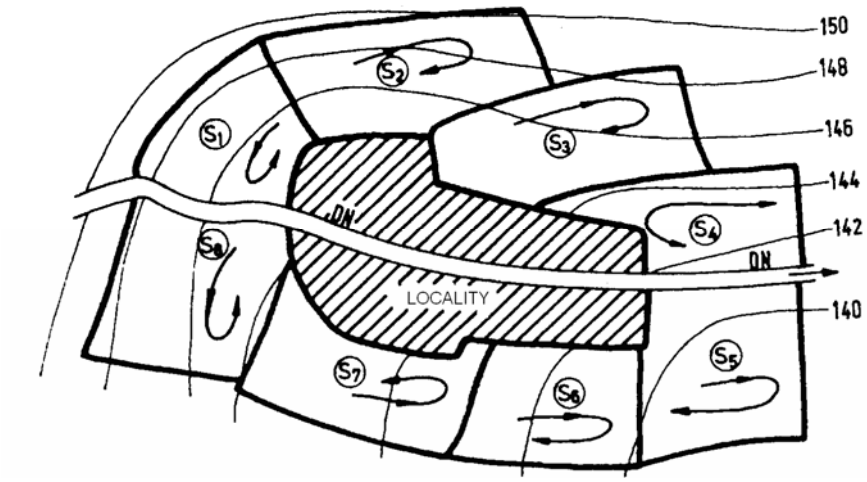

Fig. 3 – Radial plots near the village

Linear placement can be achieved in case of long perimeters, of villages placed along highways or roads. Land elements are disposed transversally, upon border limits, along valleys, railways, roads, etc. (figure 4).

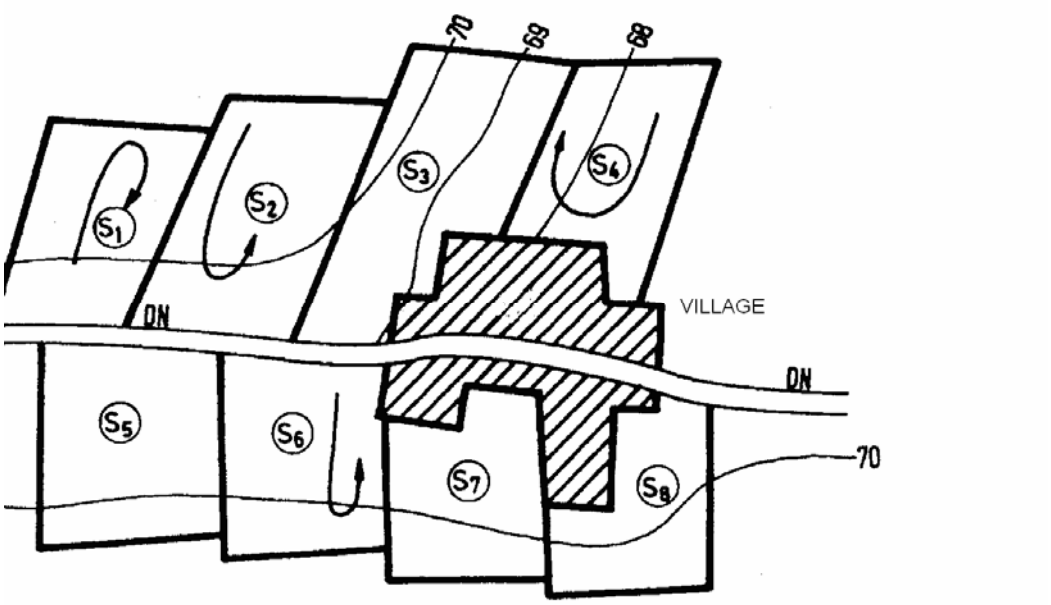

Fig. 4 – Linear placement of plots

A dispersed placement consists of a plot scattered position, c) a mixed, complex placement consists in a radial and linear plot positioning. This disposition represents the most usual case ever met.

5.5 Plot Placement in Relation to Natural Limits

When designing the plots we must follow the lines of existing compulsory limits (natural borders, roads, railways, classified roads, platforms, forested mountains, protection screens, rivers, valleys, streams, irrigation and draining canals, etc.
All these are done in order to avoid surface fragmentation and create efficient conditions for exploitation. Irrigation and draining activities ask for plot change taking into account canal positions and buried pipe networks.

5.6 Protection Crop Rotation Positioning

On slope lands protection crop rotation are necessary as contour strip cropping and grassed bands (figure 5).

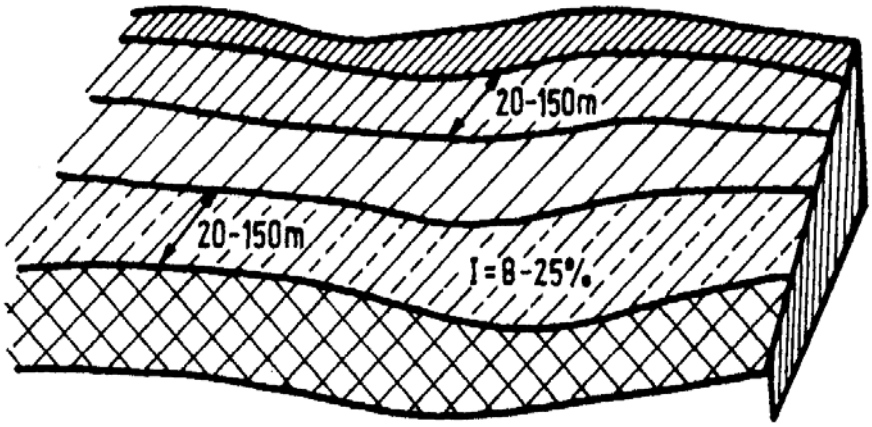

Fig. 5 – Contour strip cropping positioning

6. LAND MANAGEMENT AND PLANNING IN VINEYARDS

This one comprises the following items:
- Location and sizing of land and working units (plot, field, body, massive);
- Location of transport network and return zones;
- -Location of land improvement.

The plots are polygon-shaped (rectangle, parallelogram, square and sometimes rhombus or triangle. The length of the plots is 100-300 (400) m, and it must be correlated with the distance between rows. Plot width is about 80-120 m, according to the length of espaliers and cropping distances.

On slopes bigger than 20%, a 100m length is compulsory. On slopes between 5 and 20% the frequent lengths are 100-300m, while on plane lands (I<4-5%), lengths of about 300-400m are recommended.

Plot surfaces are not bigger than 1-3 ha (for slopes of 5-15 %), going under a ha for rugged surfaces and great slopes and reaching a maximum of 5 ha for light slopes under 4% and a uniform relief.
Plots are chess-like for preventing erosion processes and ensure stream concentration along the paths that line the plots on their long side (figure 6).

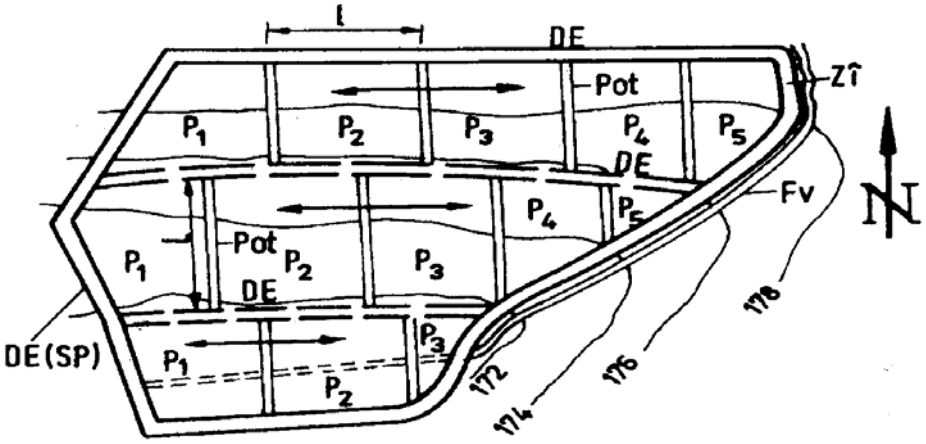

Fig.6 – Plot positioning on a slope
RE- road for exploitation; WR- winding road; Pa- Paths;
BR- backing road; VL- valley line

All vine rows will be placed parallel with level curves in order to prevent soil erosion.
- To choose species and sorts, their distribution in the field and means of support;
- The distribution of built-in areas and water supply mapping out (in un-irrigated plantations).

Roads are of two types: main and secondary according to the traffic volume.
The main roads connect the various production centers, the highways, the plots and the bodies, have two lanes and are 6m in width and lead the way to the plots and fields.
The road slope is under 8-10%. On roads with its slope bigger than 10%, windings must be plotted (figure7).

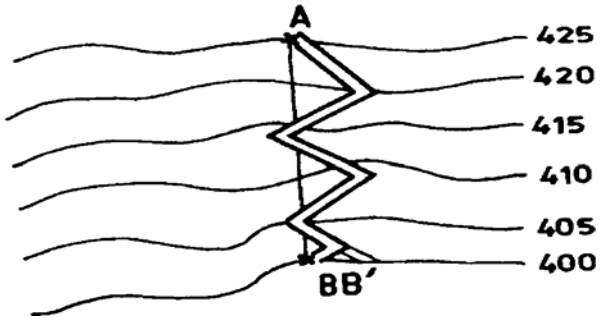

Fig. 7 – The mapping out of a winding road in a vineyard

Roads will be mapped out on stable areas, unaffected by slidings, coastal streams or alluvia, along canals, along valley lines, of rivers or along level curves. The roads on level curves are terraced and endowed with side ditches upstream for collecting and directing rain waters.

The turning points are used for machine returns and they limit the plots on their small sides. They are 4m wide for carts, 4-8 m for mechanical devices and up to 10 m for the mechanical grape harvesting. They are designed on the highest slope line, on the lines of roads, outlets, ravines.

Shadowing areas are placed close to protection plantations, high fruit trees or forested mountains. Their width varies between 3-8m, according to species.
Paths are pedestrian access spaces which limit the plots on their long sides. They are chess-disposed, 2m in width and 100-500 m long and they are kept covered with grass. When the slopes are steep, the paths are made like steps.

7. LAND MANAGEMENT AND PLANNING ON PASTURES

Pastures represent 175 of the total surface of our country, with 75% situated on slopes. The management of pastures aims at the increase of green mass quantity, for rational grazing, the use of landed resources in a more rational way, while on slope lands: leaking reductions and prevention of soil erosion.
The grazing units are divided into plots or fields. On slopes, the plots are placed with their long side along level curves, imposing grazing on the same direction. On plains, the length of plots (L) are influenced by the limits of usage categories, hydrographic network or the transportation network (figure 8a).

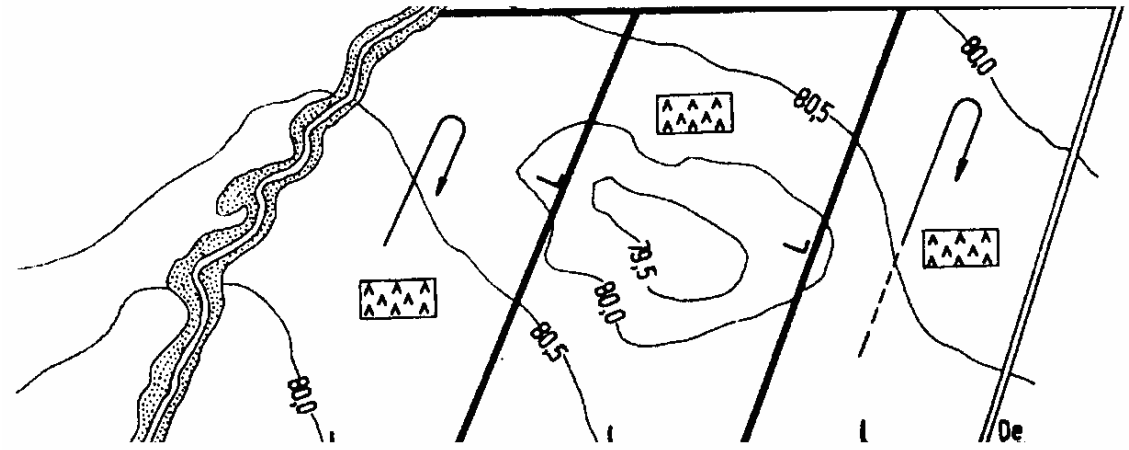

Fig. 8a – The placement of pasture plots on plane lands

Plot width (I) is equal to the very width of the grazing front which is established, for practical and technological reasons, at 1-2 m for cows, 1-1.25 m for young animals, 0.5 for calves, 0.2-0.4 m for sheep.

Plot surfaces is established in length and width and it may be calculated in relation to the number and animal category, the quantity of fodder for the whole herd, green mass production and the number o9f grazing days on a plot.

The number of grazing plots for a herd or flock can be determined by the number of days necessary for the vegetal carpet to regenerate from a grazing cycle to another, by the number of grazing on a single plot and by the number of free plots left for pasture regeneration. The positioning of plots on a slope, of transport network and auxiliaries are shown in figure 8b.

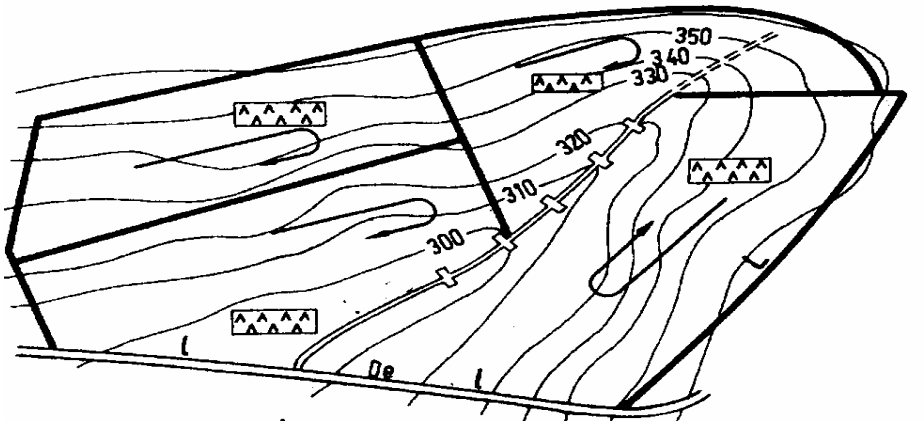

Fig. 8b – The positioning of pasture lands on slopes

Transport network mapping up is very important for sloppy areas where errors may lead to forms of deep erosion. Transportation network comprises: access ways, 6-8 m wide and steep forest paths, 10-12 m only for animals. They must be bordered by net fences, hedges and electrical fences.

All these must ensure animal access to each plot, the access to the summer camps, to shadowing and watering places. These ways must not represent more than 0.5-0.8 % of the total pasture area.

7.1 Anti-erosion Actions on Pastures and Vegetal Carpet Regeneration

All requirements are taken into account if we want to preserve grass carpet uniformity and must be analyzed in determining all exploitation units and grazing plots. To protect soil and the vegetal carpet we sow, re-sow and over-sow the plots. Among agro-technical measures we mention non-edible vegetation removal from plots, stones, hedges, ant hills as well as periodical fertilization with chemical, organic fertilization. Vegetal carpet regeneration can be done properly by using alternative grazing between species.

8. CONCLUSIONS

1. The organization of the agricultural territory in Romania, which represents 60 % of the landed resources of the country, aims at:
    - To create conditions for a complete and rational management of natural resources, of all technical endowment within all agricultural units;
    - To create economical conditions for introducing new technologies in agricultural production, highly recommended by scientific research.
2. The major factor in agriculture and its main pre-requisite for increasing production is the rational, complete and intensive use of the land.

3. The crop rotation, as an integral part of land management, represents a method of rationally preserving and using of soil.

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