SOME NOTES TO SILVAMIX® FERTILISERS AND TO FERTILISING OF FOREST PLANTATIONS

Vaclav **NAROVEC** & Antonin **JURASEK**

Forestry and Game Management Research Institute Jiloviste-Strnady (Prague)
Forest Research Station at Opocno

Silvamix®: a slow release fertiliser

Silvamix® fertilisers belong to a special group of the so-called slow-release fertilisers. Generally, in case of these fertilisers manufacturers try to assure in different ways a slow release of nutrients into the root zone of plants and to reduce inefficient losses of supplied nutrients via volatilisation or leaching. At the beginning the development of these fertilisers was oriented to satisfying the needs of agricultural practice that required a differentiated release of individual nutrients, especially of nitrogen. Later on, the assortment of produced slow-release fertilisers was used also in different branches of plant production and finally also in forestry.

The specific trait of Silvamix® fertilisers represents the fact that their development and subsequent production have been implemented only in accordance with requirements of silvicultural practice since the year 1983. Such fertilisers should be used above all for nutrition of plantations of forest woody species established in immission-affected sites of Ore mountains *(Krusne hory)* in North Bohemia. Its specific composition was formulated by the management of North Bohemian State Forests (for details see and article published in the scientific journal *Lesnicka prace*, No. 10/1987, p. 441 - 445).

The requirement concerning a slow release of all nutrients and optimisation of the chemical composition of all original raw materials was solved by the manufacturer (initially the UAC Prace Lechovice, now Ecolab Znojmo, Ltd.). Ureaforms, i. e. condensates produced through a chemical reaction between urea and formaldehyde, are used as a source of slow-released nitrogen. Their properties are dependent on percentages of both components mentioned above or, better to say, on the length of the polycondensate chain. A slow release of other nutrients (P, K, Mg) results from a low solubility of potassium-magnesium diphosphate $KMgPO_4$ Dynamics of nutrient release from Silvamix® fertilisers thus depends above all on quality of raw materials used. Effects of subsequent technological modifications (e. g. pelleting to a required form) are of only secondary importance. Laboratory and field tests (carried out for example by the Research Institute of Inorganic Chemistry Usti nad Labem, University of Chemical Technology Prague etc.) demonstrated that Silvamix® products show a character of PP-fertilisers and that the release of nutrients from them takes place for at least two years (for details see fir instance an article in *Agrochemia*, No. 12/1991, p. 278 - 282).

Experiences with Preform pelleted fertilisers

The principal difference between Silvamix® and Preform pellets consists in a slow release of nutrients. Preform pellets were widely used in the Czech silviculture within the period of 1987 - 1992. In contradistinction to Silvamix® series Preform fertilisers consisted of easily soluble components (urea, potassium sulphate, and superphosphate). Addition of Mg and Ca components enabled to pelletize the original raw material but for the price of a significant reduction of the proportion of water-soluble form of phosphorus in the fertiliser. In lysimetric assays that were performed with Preform pellets in the Forest Research Station at Opocno (Forestry and Game Management Research Institute) it was found out that nearly all nitrogen and a substantial part (70 %) of potassium was washed off from the fertiliser already within 2 months of the experiment. However, phosphorus was not released from Preform pellets. In some batches of Preform pellets it was found out that their mechanical properties changed during the storage and handling (high abrasive wear, formation of cracks boh on the surface and inside pellets, breakage of pellets etc.) which resulted in further complications when applying this product in forest stands (for details see *Lesnicka prace*, No. 12/1991, p. 365 - 368).

Differences between both products are mentioned here also due to the fact that here are many opinions concerning the use of peletted fertilisers in forest nurseries and stands. However, these opinions are often presented on the base of personal experience with the use of concrete types of eletted fertilisers. Such opinions are thereafter generalised and associated also with other products that have only one common property, i. e. peletted form. Production of peletts of different size and shape should only facilitate the application and differenciated dosage of each fertiliser. The shape of peletts, however, does not define properties of each individual product.

Declaration of properties of PP – fertilisers

Basing on facts mentioned above it can be concluded that the users should ask both manufacturers and suppliers of PP-fertilisers to present not only chemical composition of fertilisers but also data about their primary components, solubility, release of nutrients and the so-called agrochemical efficiency after the application into the soil or nutrient medium. It is also expected that the producers of PP-fertilisers will develop and introduce systems of quality control into practice. In this way they will be able to inform their customers about some specific properties of individual batches of fertilisers. This possibility is important also in case of fertilisers base on ureaforms (i. e. for fertilisers of Silvamix® series) because urea-formaldehyde concentrates can, because of their character, show higher or lower variability in individual properties and quality traits of final products. If, for instance, the manufacturers will use ureaforms of different quality supplied by different contractors for production of PP-fertilisers then the dynamics of nitrogen release from pellets could be so different that experiences obtained in one year need not be applicable in another situation or in years to follow.

The fact that the manufacturers speak about "business secret" in case of presentation of data about components and technologies used for production of these fertilisers should alarm and discompose us. This comment does not concern the manufacturer of the Silvamix® fertilisers but is, unfortunately, very topical in case of other manufacturrs of pelleted products. In our opinion, the capability of manufacturer to declare, manage and control certain quality properties of PP-fertilisers is one of the most important factors that influence our decisions about the use of individual product in silvicultural practice.

Application of fertilisers in forest regeneration

At present, fertilisers are most frquently used for purposes of forest recovery in regions affected by immissions. In these regions, fertilisation is an integral part of a complex of silvicultural measures focused to a successful regeneration of forest stands and nutrition of young plantations. It involves both modification of soil environment (i. e. application of fundamental nutrients or the so-called basic fertilisation of soil) and formation of conditions for successful growth of young stands (i. e. the so-called operative application of fertilisers in forest stands). However, objectives of these two measures are a little different.

In the first case, a general modification of soil chemistry should trigger regradation of nutrient cycling in disturbed forest ecosystems and/or reduce negative effects of acid precipitation on soil. This is done by means of application of Ca and P fertilisers that are applied even several years before reforestation or, in case of necessity, at the moment of soil tillage before planting of seedlings. Project of this fundamental fertilisation are elaborated on the base of results of soil analysis and/or land reclamation surveys.

Operative fertilisation should above all promote the growth of forest stands and improve their health condition. In this case, multi-component or combined types of nitrogen fertilises are use. Single-component (e.g. magnesium) fertilisers are used only in those cases when it is demonstrated by leaf analyses that the growth of forest stands could be limited by a deficiency of a single element. A generalised method of fertilisation is used only exceptionally; the most frequent is the application of powdered or pelleted fertilisers to individual trees directly on the soil surface. Granulated fertilisers or pellets could be used as well and they are put either on the soil surface or into the root zone of woody species (see Figure 1). These fertilisers are applied in that part of the growing season when the plants can easily absorb the supplied nutrients, i. e. early in th spring when the growth of annual shoots begins; the latest term for application is the first half of July. The dose of fertilisers must be always adapted to the current condition of forest stands and the general principles of differentiation of dosage of the most common fertilisers in forest stand of different age are summarised in Table 1.

Efficiency of fertilisers and its testing

Practical efficiency of fertilisers should be evaluated with regard to the defined objectives of fertilisation and plant nutrition. The positive effects of basic fertilisation should results in changes in soil chemistry while those of operative fertilisation can be evaluated on the base of improved growth and health condition of plants, i. e. in lower losses of young seedlings, better development of leaves, greater amounts of produced biomass, better timber increments etc.
The evaluation of the efficiency of fertilisers is sometimes very problematic due to many factors (e. g. soil condition or health status of plantations) that contribute to results of fertilisation in forest ecosystems. The fact that in a concrete experiment the application of one fertiliser results in one variant in much higher increments of terminal shoots of seedlings than in others and/or in non-fertilised control need not be an indication of "inferiority" of evaluated product as compared with others. Quite on the contrary, even the positive examples of a successful application need not be identic and/or similar when repeated under different conditions. Results of application of fertilisers in forest nurseries or plantations are often very variable and can say more about our ability to prepare and implement a plan of fertilisation or nutrition of plants than describe the properies of the fertiliser itself.

Conclusion

All these facts suggest that it is necessary to be a little reserved when drawing general conclusions from results of concrete cases of application of fertilisers in forest management. None of such results should be considered without a certain criticism. In forest management, each case of application of fertilisers may be completely unique and the viewpoints of evaluation of individual problems may be different, too.

* * *

Orig. citation (only in Czech):
Narovec, V., Jurasek, A. 2000: Nekolik poznamek k prihnojovani lesnich kultur. *Lesnicka prace, 79*, (4): 176 - 177.