# Improving permanent pasture's growth: An organic approach

Colmenares R., Miguel J.-M. de

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# Improving permanent pasture's growth: An organic approach

**R. Colmenares* and J.M. De Miguel****
*Centro de Investigaciones Ambientales de la Comunidad de Madrid,
Fernando González Bernáldez (CIAM), San Sebastián 71, 28791 Soto del Real, Spain
**Departamento de Ecología, Ciudad Universitaria SN, 28040 Madrid, Spain

**SUMMARY** - Organic agriculture claims to provide a sustainable way to produce enough quality food for today's needs. Within the framework of organic agriculture exists the biodynamic school of agriculture. The effect of the application of biodynamic preparations on permanent pastures along the altitudinal gradient in the NW of Madrid is presented here. During a period of three and a half years on experimental plots established on three different commercial farms two parameters on pasture growth were monitored: pasture yield and pasture dry matter content. The results obtained suggest that biodynamic preparations enhance an optimal development rather than just growth, i.e. focusing on improving pasture quality rather than just its quantity.

**Key words**: Permanent pastures, biodynamic preparations, pasture yield, pasture dry matter content.

***RESUME*** *- "Amélioration de la croissance des pâturages permanents: Une approche biologique". L'agriculture biologique prétende produire une nourriture de bon qualité pour les besoins du présent sans répercussions négatives globales. Dans l'agriculture biologique existe l'école de l'agriculture biodynamique. Ici, on présente une étude sur les effets de la application des préparations biodynamiques sur des pâturages permanents dans le zone nord-ouest de Madrid. Pendant trois ans et demi, dans des parcelles expérimentales établies à trois fermes commerciales, on a contrôlé deux paramètres en particulier : le rendement du pâturage et son contenu de matière sec. Les résultats ici obtenus suggèrent que des préparations biodynamiques rehaussent un développement optimal et pas seulement de la croissance même, autrement dit : mettre l'importance sur l'amélioration de la qualité, plutôt que de la quantité.*

***Mots-clés*** *: Le pâturage permanent, les préparations biodynamiques, le rendement du pâturage, le contenu du matière sec.*

## Introduction

Organic agriculture is legally defined and regulated within the European Union in the EC Regulation 2092/91. Van Mansvelt and Mulder (1993) showed how close are the achievements and developments of organic agriculture to the values and interests formulated by the FAO (1992) for sustainable development.

Biodynamic agriculture, the pioneer school of modern organic agriculture, relies on new scientific paradigms based on Goethe's scientific researches and elaborated and transformed further by Rudolf Steiner in new agricultural practices to regenerate modern agriculture (Steiner, 1924). The use of biodynamic preparations plays a central role in this agricultural school to enhance life processes within the farm individuality depending on particular cosmic and terrestrial rhythms. Biodynamic preparations include two sprays which are used for soils and plants: 500, based on cow manure, is applied at a rate of about 200-300 g $ha^{-1}$; and 501, finely ground quartz, at 4 g $ha^{-1}$. Two to 4 ppm of yarrow, camomile, stinging nettle, oak bark, dandelion and valerian flowers, preparations 502-507 respectively, are added to manures and composts (Koepf, 1981). For details of how these substances are processed and applied see Sattler and Wistinghausen (1992). There is experimental evidence for the beneficial effects of these preparations on crops, soils and organic manures (Koepf, 1993; Lammerts van Bueren and Van Mansvelt, 1996).

In this paper we provide for the first time experimental data about the effect of the application of biodynamic preparations alone (i.e. no fertilizer was applied) on non-crop plants growing on non-tilled soils, i.e. Mediterranean permanent pastures living under polar environmental conditions.

## Material and methods

The study area is located at the NW of Madrid city, in the centre of Spain, on the south-facing slopes of the Central System with a continental Mediterranean climate very much conditioned by a strong gradient in altitude existing in the area (in only 60 km the altitude varies from 600 m a.s.l. nearby Madrid city, with 13.8°C annual mean temperature and 432 mm annual rainfall, to 2,300 m a.s.l., with 6.3°C temperature and 1,331 mm rainfall). The rock composition is mainly granite, gneiss, gravel and sand. The main traditional land uses in the area are forests and grasslands with extensive livestock systems.

To investigate experimentally the effect of the application of biodynamic practices on the permanent pastures of the area a set of four 50 square metre plots (two control and two treated with the biodynamic preparations) with a latin square lay-out was established in three commercial farms within the study area located at 750 m Farm 1 (F1); 1,050 m Farm 2 (F2); and 1,460 m Farm 3 (F3) a.s.l. respectively. The three farms have the same soil texture: sandy loam. The experiment spanned a three and a half years period (1992-1995).

The biodynamic preparations were applied according to the recommendations of the biodynamic method (Sattler and Wistinghausen, 1992): compost preparations as cow pat pit (Maria Thun preparation) in late autumn or early winter, and the two field sprays (500 and 501) at the time of early spring growth and full growth respectively. A proportion of 3 g of Thun preparation, 5 g of 500 and 0.1 g of 501 in one litre per each 100 square meters of treated plots in each farm was used. The repetitions and timing of the applications were done according to local conditions at every altitude every year. The pasture biomass protected under movable cages was sampled every month cutting the grass to ground level within four 20 x 20 cm squares under the cage and the same number outside it.

## Results and discussion

### Pasture Yield

Weather conditions during the experimental period were rather dry and warm in the area with the exception of year 1993 which was more wet and cold (Colmenares and De Miguel, 1997). Typical winter pastures in F1 grew more on mild autumn-winter months than on hot spring-summer months. On the contrary, typical summer pastures in F3 grew more on mild spring-summer months than on cold autumn-winter months. Pastures on F2 in an intermediate location behaved in between: closer to F3 in spring-summer months but closer to F1 in autumn-winter months. Biodynamic preparations worked inhibiting or enhancing pasture yields depending on environmental conditions but always enlarging the growth period and increasing yields at the end of the growth period: summer for F1 and F2 and autumn for F3. As a result pasture treated in F2 presented the highest positive difference in the mean pasture yield for the whole experimental period compared to the non-treated: 11.4%; and next F1 pasture treated: 10.6%. However, on F3 pastures the difference was negative: 8.3% lesser for treated plots (Fig. 1).

However, there were no statistically significant differences in pasture yield between treated and non-treated plots; these results show the same tendency as those published recently by Lammerts van Beuren and van Mansvelt (1996) for temporal grasslands, lettuces and apple trees. In particular with regards to grasslands they report that in Holland biodynamic preparations inhibited the development of grass growth in spring and enhanced it in autumn. Between mowings they noticed also that growth was retarded in the first regrowth stage and stimulated later on.

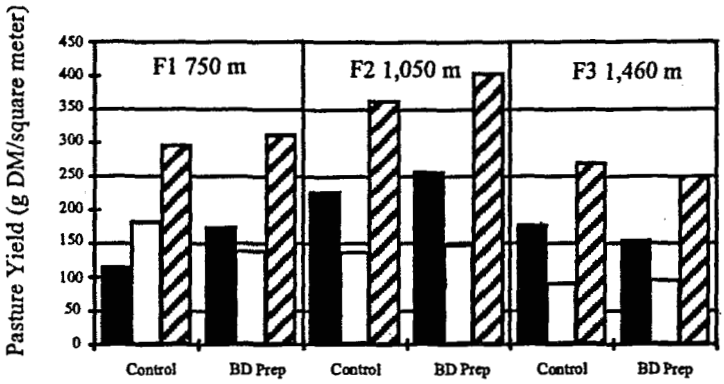


Fig. 1. Differences in pasture yield (g DM $m^{-2}$) between plots treated and non-treated in the three experimental farms for the whole experimental period. Filled bars are for Spring-Summer periods, open ones are for Autumn-Winter periods and striped bars are for annual periods.

## Pasture dry matter content

The differences in the mean dry matter content of the pasture during the whole experimental period between plots treated and non-treated decreased according to altitude. This difference was always positive for pastures treated with biodynamic preparations: 4.5% ($p<0.05$ paired Student t test) for F1; 3.4% (ns) for F2; and 1.8% (ns) for F3. In F1 and F2 the difference was higher during warm periods: 5.5% ($p<0.05$) versus 3.8% ($p<0.05$) for F1 and 4% (ns) versus 2.8% ($p<0.05$) for F2. The reverse was found in F3, where a higher difference on cold periods was recorded: 4.2% (ns) versus 0.2% (ns) (Fig. 2).

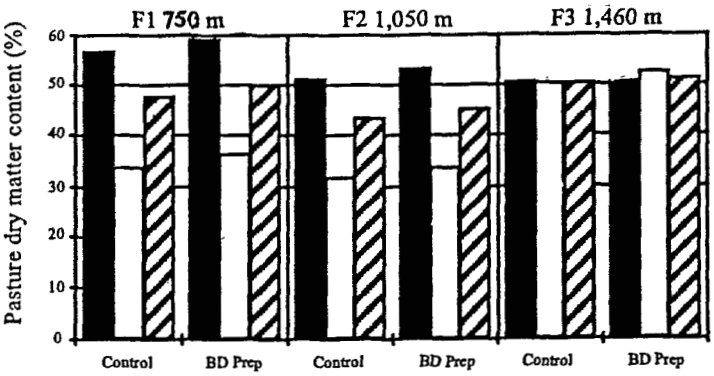


Fig. 2. Differences in pasture dry matter content between plots treated and non-treated in each farm for the whole experimental period. Filled bars are for Spring-Summer periods, open ones are for Autumn-Winter periods and striped bars are for annual periods.

The dry matter content of a plant is often used as indicator of quality and health (balanced content of nutrients) in comparative experimental studies involving arable/garden crops growing under conventional and organic management (Lampkin, 1990; Koepf, 1993; Meier-Ploeger and Vogtmann, 1996). In our experiment, in contrast, the comparison involved natural permanent pastures grazed, but non-tilled, non-fertilized (only with the manure from the grazing cattle) and non-reseeded. We just compare the use of biodynamic preparations (compost and field sprays altogether). Thus, the significant differences found here are remarkable and new in scientific literature.

Montalvo *et al.* (1991) have discussed the existence of a gradient of ecological persistence along the altitudinal gradient of the study area affecting species composition as well as morphological and functional traits of the grassland communities existing there. This gradient runs from less persistent or more changing (lower altitude) to more persistent (higher altitude). These differences in persistence correspond to a gradual change from species with ecological strategies r to K. So our results seem to be closely related to the ecological persistence of the pasture community involved. Biodynamic preparations changed the dry matter content of the pasture more clearly in less persistent communities with predominance of annual plants.

## Conclusions

(i) The results obtained support the bioregulation role attributed to biodynamic preparations, in that pastures treated obtained mainly a higher dry matter content in all environmental conditions. This suggests that pasture development is balanced and enhanced through a better use of the resources at hand to get the healthiest plants possible. In addition, the dynamics of yields suggests that preparations slow down and enlarge the growth period of pastures leading ultimately to fully developed healthy plants.

(ii) Looking at the results under different environmental conditions, biodynamic preparations show more clear effects on pastures living under unpredictable environments than on those living under predictable environments. However, in particular with pasture yields, the effect seems to be more clear on pastures living under balanced environments.

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