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Supporting herders and improving forage production in the South side of Alps – A development project

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Abstract. Meadows and pastures play a vital and economic role for both agriculture and tourism along the Southern side of the Alps. In 2007, an interdisciplinary project was launched aiming at supporting herders and improving forage production in the South side of Alps by implementing specific tools. Therefore it is not a fundamental research project, but rather applied research. Specific activities were implemented in two different axes: the grassland characterization and the analysis of farm systems. Regarding grassland characterization, it was highlighted a great seasonal variability in terms of biomass production, phenological development and nutritive quality. The botanical composition was also analysed and 9 types of vegetations have been identified. This leads to serious repercussions on the harvesting that should be adapted according to specific meteorological conditions of each year. As concerns the analysis of farm systems, we found that the agricultural income of all farms depends heavily on subsidies paid by the Swiss Confederation and that high performing farms are often not viable and autonomous. With the purpose of improving the agricultural income and the productive efficiency, farmers could intervene on animal breed and on related feeding, consisting in type, given amount and quality of food.

Keywords. Grassland – Grass-growth – Phenology – Farm typology – Farm efficiency.

Soutien aux éleveurs et amélioration de la production fourragère au Sud des Alpes

Résumé. *Prairies et pâturages jouent un rôle primordial pour l'agriculture et le tourisme au sud des Alpes. En 2007, un projet multidisciplinaire qui vise à soutenir les éleveurs et l'amélioration de la production fourragère au Sud des Alpes a été lancé en mettant en œuvre des outils spécifiques. Donc, il ne s'agit pas d'un projet de recherche, mais plutôt d'une recherche appliquée. Des activités spécifiques ont été mises en œuvre dans deux axes différents : la caractérisation des prairies et l'analyse des systèmes agricoles. En ce qui concerne la caractérisation des prairies, on a remarqué une grande variabilité saisonnière en termes de production, de développement phénologique et des valeurs qualitatives. La composition botanique a été aussi analysée et 9 typologies de végétation ont été identifiées. Cela a des répercussions sur la récolte qui doit être adaptée en fonction des conditions météorologiques spécifiques de chaque année. En ce qui concerne l'analyse des systèmes agricoles, nous avons constaté que le revenu agricole des exploitations agricoles dépend largement des subventions versées par la Confédération Suisse et que les exploitations très performantes ne sont souvent pas autonomes. Dans le but d'améliorer le revenu agricole et l'efficacité productive, les agriculteurs pourraient intervenir sur la race animale et sur l'alimentation du bétail, pour ce qui concerne le type, la quantité et la qualité des aliments.*

Mots-clés. *Prairies – Croissance de l'herbe – Phénologie – Typologies de fermes – Efficience de ferme.*

I – Introduction

In 2007, local partners and the Swiss Grassland Society (APF) launched a research & development project aiming at supporting herders and improving forage production in the South side of Alps by implementing specific tools (Nucera *et al.*, 2013). Since then, some new activities were

lunched linking research results, political and legal concerns into the real system at both farm and territorial level, according to stakeholders needs. The need for a better understanding of permanent grassland composition and behaviour was also highlighted, as consequence of a lack of knowledge in the southern side of Alps, despite they represent about 80% of UAA (USTAT 2013). This paper presents results of the botanical characterisation of semi-natural grassland over years and of an inquiry realized in two main agricultural valleys of Ticino. The objective was to define farms typologies and to evaluate their autonomy and the efficiency of some practices to better understand the role of local forage resources in such a systems.

II – Materials and methods

The activities were implemented in two different axes: (1) the grassland characterization; (2) the analysis of farm systems

1. Grassland characterization

Different surveys were conducted in diverse sites to improve the knowledge of this topic with the objective to disseminate and to discuss the results with farmers and other stakeholders. They concerned: (i) grass growth; (ii) phenology development; and (iii) botanical composition.

(i) Grass growth was evaluated by a simplified Corral – Fenlon device (Corral and Fenlon 1978, Mosimann, 2011) in three different sites at various altitudes. The experimental design was used to quantify the DM yield of permanent pastures. On each plot, botanical composition was determined along 7.5 m transects of 25 points (Daget and Poissonet, 1971).

(ii) The springtime phenology of 25 semi-natural meadows distributed among the principal thermic levels was observed according to the method developed in Switzerland (Meisser *et al*., 2008). The results allowed the characterization of the average stage of meadow development.

(iii) Botanical surveys on 58 farm meadows and pastures were carried out according to linear point quadrat method (Daget and Poissonet, 1971) in order to characterize the vegetation, considering also the applied management practices. A hierarchical cluster analysis was performed to classify botanical surveys in typological groups.

(iv) Various samples of grazed grass were collected to analyse grassland chemical composition with NIRs instrument. Each sample was collected in livestock fence in order to determine the effective pasture quality, expressed in MJ of NEL (Net Energy for Lactation).

2. Analysis of production systems (PS)

In order to understand the characteristics of farms using grassland as main forage resource, 38 interviews were conducted in two main agricultural valleys where grassland analyses were implemented, with the purpose of (i) identifying different types of farms, and (ii) evaluating farm efficiency and forage self-sufficiency.

(i) Farms were grouped in PS according to comparable resources, organization, tasks and results. In order to analyze and to compare different PS we used the agricultural income: an economic indicator that identifies the effective revenue for the farmer.

(ii) Through the same interviews we also detected for each farm: the livestock daily ration, the use of concentrate (meal) and the average purchased fodder during the year. To compare collected data, each ration was converted into MJ of NEL (Net Energy for Lactation) and in kg of protein. In addition, to assess the degree of farm forage self-sufficiency, purchased animal feeds were converted into “equivalent hectares” according the method developed by the Swiss Grassland Society.

III – Results and discussion

1. Grassland characterisation

(i) Pasture production among five years showed high seasonal variability (Table 1). The three study sites expressed three different levels of production: high (Cadenazzo – Ti, deep soil), medium (Semione – Ti, medium deep soil) and low (Lostallo – GR, superficial soil).

Table 1. Yearly and average biomass production (ton DM*ha^{-1}), and standard deviation for each site

Site	2009	2010	2011	2012	2013	Average production[1]	Standard deviation
Cadenazzo (203 m.a.s.l)	14.2	13.1	13.6	13.7	14.9	13.9	0.62
Semione (370 m.a.s.l.)	/	/	8.7	9.8	6.9	8.4	1.23
Lostallo (421 m.a.s.l.)	/	3.8	3.6	7.2	7.6	5.0	1.95

During five years of observation we noticed that biomass production is fairly the same, however a variation in the seasonal distribution of production was observed (data not shown). Especially in Cadenazzo (the most productive plot) the spring growth peak (80 kg DM*ha^{-1}*d^{-1}, average) had been lower than the summer one (93 kg DM*ha^{-1}*d^{-1}, average) for three years, due to the C4 species (especially *Setaria* spp.).

(ii) During the years (2009-2013) of observation a great variability was registered with a delay between 2010, the latest year, and 2011, the earliest year, in the achievement of the "full earing" stage, respectively 3-5 May and 15-17 April (data not shown).

(iii) 9 main vegetation types were identified through hierarchical cluster analysis, according to botanical composition, ecological conditions and managing practices. As a consequence, the great variability of semi-natural grassland of the South side of the Alps was brought out.

(iv) As concerns the grazed grass chemical composition, the analyses showed a different quality almost due to different management practises, as number of days in the same fence or grazing in a phenological tardy stage.

2. Analysis of farm systems

(i) The interviews led to identify 4 main production systems (Armellino and Levitre, 2013): "cow's milk with silage" (PS1); "cow's milk without silage" (PS2); cow's milk transformed in the farm" (PS3); "small ruminants" (PS4).

The results showed that for all farms in the study area, despite the important variability, the agricultural income depends heavily on subsidies paid by the Swiss Confederation (Table 2).

Table 2. Income, expressed in 10^3 CHF, with and without subsidies for each production system (PS)

Economic indicators	PS1 (n = 11)	PS2 (n = 12)	PS3 (n = 4)	PS4 (n = 11)
Income – no contribution	-24 to -8	-8 to 50	-14 to 39	-26 to 24
Income – with contribution	30 to 63	30 to 65 (84)	25 to 86	45 to 68 (62)

(ii) Nutritive value of the ration was very variable, with NEL value between 7 MJ and 525 MJ for bovine unit per year (160 MJ as average) and protein value between 70 kg and 1200 kg per bovine unit per year (400 kg as average).

Thus, we could affirm that abundant rations, which often coincide with high costs, do not always correspond to milk production increase and to a lofty income. From these observations it is clear that choices regarding animal breed and related feeding, given amount and quality of food, are between the main factors that a farmer can modify to improve productive efficiency.

In addition we found that examined farms buy quantities of forage and concentrates, which corresponds to 192.15 equivalent hectares: an area equal to one-sixth of the surface they already manage (1200 ha of utilized agricultural area).

Farms belonging to PS3 (on farm transformed cow milk) often are more viable and more autonomous. Thanks to transformation activity they can get more add value, despite a higher work charge, and they don't need big quantities of milk. Similar consideration could be done for PS2: large part of farms belonging to this system deliver their milk to mountain dairy, capable of valuing product (especially cheese) on the market, even if in this system we recorded many high input farms. No silage milk production is encouraged by the Confederation with 0.03 CHF/kg milk, and transformation in cheese with 0.14 CHF/kg transformed milk. Farm belonging to PS1 normally deliver their production to industrial (or semi-industrial) dairy out of mountain zones (than for the Swiss designations "mountain" and "alp" (ODMA, 2011), they cannot use the denomination "mountain" for the transformed product) and most of them are going to switch to PS2, especially in mountain areas. Farms belonging to PS4 are very varied: there are milky goat farms, which are very autonomous and economically viable thanks to direct sale and low cost production. For sheep farm the only agricultural income is the sale of lambs, very seasonal, which gives rise to a low income. They are therefore very dependent on the contributions (Armellino and Levitre, 2013).

IV – Conclusions

During the last five years we tried to define the image of Ticino farming system starting from grassland resources to the farming system: we highlighted the great diversity of semi-natural grassland of South side of Alps and their role in the farms strategy. A deeper comprehension of grasslands characteristics and services is needed in order to advise farmers about the best utilization strategy and to explain the important potential of meadows and pastures, as fundamental principle of a *terroir,* able to create the basis for a market differentiation for dairy products.

Among the production systems we noticed that high specialized farms are often not viable and autonomous, and farms which have other activities, such transformation and direct sale, don't need great production and high input to be more viable, despite the high work charge.

What is the future for mountain and alpine Ticino's farms?

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