NEW WAYS OF INCREASING BIODIVERSITY ON ORGANIC FARMS

AND THEIR EFFECTS ON PROFITABLILITY

THE NATURE CONSERVATION FARM BRODOWIN –

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Abstract

Although organic farming systems have many positive biotic aspects, the protection of target species characteristic of open landscape is not guaranteed. Specific knowledge and financial incentives are necessary in order to integrate nature conservation goals successfully into agricultural practice. The main objectives of the interdisciplinary 'Nature Conservation Farm Brodowin' project are: the investigation of the interactions between large-scale organic farming and nature conservation; the identification of points of conflict; and the working out of solutions that pay sufficient attention to economic aspects. Legume-grass forage is important for typical species of farmland wildlife. Alternative methods of fodder production which better meet nature conservation demands are evaluated economically. Initial calculations of the compensation payments required to offset the losses of a higher first cut range between 120 and 180 Euro/ha. A delayed second cut would cost on average twice as much. The losses and additional operational expenses incurred by retaining 10 % unmown strips are approximately 90 to 140 Euro/ha. The use of special silage harvesting techniques can also help to improve the living conditions of farmland birds without resulting in disadvantages for the farmer.

Introduction/Problem

Over the past 30 years there has been a significant decline in the population of species typical of the once rich fauna and flora of open habitats such as arable fields (SRU 2003, NABU 2004). As organic farming systems take a more ecological approach, reflecting the multifunctional nature of agriculture, they contribute significantly to environmental protection (SRU 2003, Hole *et al.* 2005). The extension of organic agriculture is therefore recommended by policy makers. However, nearly all of the documented advantages of organic agriculture are based on comparisons between conventional and organic farming systems. There is still comparatively little research dealing directly with the possibilities and potential for improving nature conservation within the organic farming system itself.

Generally speaking, changing economic conditions are increasing the pressure on organic farming. This is leading to an intensification of production procedures wherein the protection of nature and natural species is taking a back seat. From the farmer´s perspective, the most important limiting factors for the integration of nature conservation into the farm organisation are time, money, and manpower. Furthermore there is a lack of specialist knowledge on the implementation of nature conservation measures in plant production procedures (Heyland 1996) and their economic consequences.

The 'Nature Conservation Farm Brodowin' project (Grimm et al. 2004), financed by the German Federal Agency for Nature Conservation (BfN), focuses on these issues. The purpose of the first 'Nature Conservation Farm' model is to address deficits in organic farming and landscape conservation whilst reducing points of conflict between ecological and agricultural goals. The focus is on improving the living and reproductive conditions of typical farmland species (farmland and hedgerow birds, amphibians, insects, mammals and segetal flora) in large-scale organic agriculture. The impact of modified farming procedures on target species and simultaneously on plant production (yield and quality) and economic parameters (cost benefit analysis) is examined. Conflicts between the long term conservation of species and short term

constraints on economic production have to be ascertained. Compromises between the demands of nature conservation and the fundamental principles of organic farming have to be worked out within the context of the whole farm organisation. Future European Union agricultural environmental programmes envisage real ecological improvements being used to claim compensation payments.

Methodology

The main project partner is the Demeter farm 'Ökodorf Brodowin GmbH and Co. KG' with 1240 ha of farmland, about 270 dairy cows and 250 young cattle. It is located in the Schorfheide-Chorin biosphere reserve in Brandenburg, 60 km northeast of Berlin. The soils are of diluvial origin with a very high small-scale heterogeneity. The predominant soil texture of the arable fields ranges from sandy to loamy. Soil rating indexes[1] range from 18 to 58 (average value 33). Mean annual precipitation amounts to 540 mm. The farm makes large parts of its agricultural land available for project investigations. Consequently, the results are obtained under real working and market conditions. The responsible body is the Ökodorf Brodowin e.V. (registered association).

The effects of nature conservation oriented field operations, such as the reduction of tillage measures, changes in mowing systems during the main reproductive season, and the implementation of structural measures are investigated at the level of the entire field, depending on the habitat requirements of the target species (e.g. breeding time of farmland birds). The effects of modified field operations on yield and product quality, subject to soil quality, are examined in large-scale on-farm experiments (Stein-Bachinger et al. 2000). Plots were placed in pairs comparable in terms of soil parameters, topography and coverage. Yield measurements performed by the farmer were taken into account. The economic analysis will be performed using a farming system approach based on linear programming techniques (Zander 2003). Restrictions with respect to nature conservation objectives, as well as restrictions at the farm and field levels (i.e. fodder production, weed control) are included. Based on a partial analysis of the ecological and economic evaluation, a comparison is made of standard and conservation oriented agricultural methods concerning yield and product quality, gross margins and e.g. reproductive success. Here, we present the results on modified farming procedures in legume-grass forage production, including a full consideration of the agricultural and economic parameters.

Results and discussion

The investigations confirm a clear preference by farmland birds and hares for forage fields (Stein-Bachinger & Fuchs 2004). Legume-grass forage, which holds a share of up to 30 % of the rotation, plays a crucial role, especially for the dairy farm. The necessity of mowing to produce high quality fodder means that these fields can become an 'ecological trap'. On the one hand, numerous species (farmland birds, hares and amphibians) are attracted and high density levels of individuals are reached, on the other hand, the successful reproduction of these animals is inhibited by routine farming operations. Beneficial effects on reproductive success can be obtained by increasing the cutting height, delaying cutting, using special harvesting techniques, and including structural features, such as unmown strips.

The increase in height of the first cut has two positive effects on nature conservation: (i) less damage is inflicted on bird broods, and (ii) the greater height of the vegetation could lead to a quicker reestablishment of broods. Hence, delaying the second cut would not be necessary. Table 1 shows the opportunity costs required to compensate for the yield losses of a higher first cut. The basis of these calculations is the measured energy-yield loss (related to the annual yield) between normal (about 7 cm) and higher (about 14 cm) first cuts conducted in two field experiments in 2002, with soil rating indexes between 35 and 40. Two different types of fodder production are chosen. In model 1 we assume that the yield losses will be compensated by additional fodder from external sources. The relative purchase rates range between 145 and 181 Euro/ha. In model 2 we postulate that the yield losses will be compensated by internal fodder production. This is achieved by reducing the production of cash crops. The calculation of the gross margin is based on a six-field crop rotation corresponding to the farmers´ current practice. The opportunity costs in model 2, which is more typical in organic agriculture, vary from 117 to 156 Euro/ha.

Table 1: Costs of a higher first cut (incl. subsidies), SRI = Soil Rating Index1), three cuts per year: [2] silage/silage/hay, [3] silage/hay/hay, [4]NEL = Netto-energy-lactation

	Field 1 (SRI[1] 40)		Field 2 (SRI 35)		
	SSH [2]	SHH [3]	SSH	SHH	
Model 1: Relative purchase rate					
Energy-yield losses	4,10	4,41	3,50	3,49	GJ NEL[4]/ha
Purchase rate	40,00	40,00	40,00	40,00	Euro/GJ NEL
Purchase for compensation of yield losses	164,00	176,36	139,83	139,71	Euro/ha
Difference in production costs	-8,34	-5,34	-5,29	-4,29	Euro/ha
Management costs (coarsely assessed)	10,00	10,00	10,00	10,00	Euro/ha
Relative purchase rate	165,66	181,02	144,54	145,42	Euro/ha
Model 2: Internal production					
Energy-yield losses	4,10	4,41	3,50	3,49	GJ NEL/ha
Difference in production costs	-8,34	-5,34	-5,29	-4,29	Euro/ha
Internal transfer price	14,11	17,98	15,14	19,79	Euro/GJ NEL
Farm costs of internal production	57,84	79,28	52,94	69,11	Euro/ha
Management costs (coarsely assessed)	10,00	10,00	10,00	10,00	Euro/ha
Required area to compensate yield losses	0,09	0,11	0,09	0,10	ha
Gross margin II of a standard crop rotation	657,00	657,00	657,00	657,00	Euro/ha crop rotation
Loss of use for not producing the standard crop rotation	61,77	72,22	59,43	65,69	Euro/ha internal production
Opportunity costs	121,27	156,16	117,08	140,51	Euro/ha

One scientifically proven method which guarantees a sufficient reproductive success of ground-breeding birds is a minimum interval of seven weeks between the first and second cuts. The huge decline in fodder quality associated with this delay, especially its energy content (Stein-Bachinger & Fuchs 2004) results in a great reduction in the amount of fodder suitable for dairy cows. As with the higher first cut, either the farmer compensates the losses with internal fodder production on other fields or with additional fodder from outside. A new amendment to the standards of organic farming, only permits organically grown fodder. Large reductions in fodder production for nature conservation reasons consequently result in high compensation payments (on average twice as high as losses incurred by a higher first cut).

Another option for improving the living conditions of farmland bird species is the retention of unmown strips (about 10% of the whole field). These strips provide potential nesting and foraging habitats, song and rest sites, as well as a refuge from agricultural operations and predators during and after the cut. At the first cut, strips with a width of e.g. 9m every 100m (depending on the available machinery) are not harvested. 10% of the field unmown means a total loss of this fodder as well as the necessity for extra mulching in autumn or spring. These losses, plus the additional operational expenses based on site conditions similar to fields 1 and 2 in table 1, amount to about 90-140 Euro/ha.

Considering the possibilities of meeting the nature conservation requirements of the target species described above, a delayed second cut does assist the successful reproduction of ground-breeding birds, but it causes a severe reduction in fodder for the farm. As an alternative, the increase of the cutting level at the first cut would minimise the economic losses and better allow the fodder requirements of a dairy farm to be met. The results also show that the fodder quality of a higher cut is slightly better due to a lower proportion of stems. Further positive effects, especially on hatching success, can be achieved by using silage harvesting methods

[1] The soil rating index (SRI) indicates the soil quality through the so-called ‘Ackerzahl’, a dimensionless parameter that ranges between 7 and 100, mainly based on different soil types and soil texture. The SRI was assigned to every acre in Germany during an assessment campaign, the ‘Bodenschätzung’, which began in the 1930s, aimed at assessing the yield capacity for fiscal and leasehold issues. The SRI is the only nationwide soil data available at field level.

rather than making hay (Stein-Bachinger & Fuchs 2004). But it should be remembered that the farmer is required by Demeter standards to produce a sufficient amount of hay as a fodder basis for the cows.

The method of leaving unmown strips may be modified so that the strips from the first cut are harvested with the second cut and new strips simultaneously left uncut. A further positive effect for nature conservation is e.g. that the availability of flowering plants for insects is better maintained throughout the whole year. Different ways of integrating unmown strips into farming operations are: either mixing the produce from the strips with the following cut, where it would lead to a deterioration in fodder quality, or harvesting it separately in autumn for seeds, which can be profitable for the farmer.

Further analysis will start with a balanced view of the whole farm organisation, site conditions and the habitat demands of the target species. It will investigate which and how many fields should be managed using nature conservation oriented production procedures. Work continues to determine which combinations or modifications of cutting regimes will ensure the productivity and health of the dairy cows and at the same time suit the farmers' economic situation. By testing various scenarios and trade-offs between production and conservation, compromises can be worked out. Within the framework of the optimisation of the whole farm, cost-efficient solutions will be elaborated which fulfil nature conservation objectives and economic requirements simultaneously.

Conclusions

Legume-grass forage offers a high potential for the protection of typical farmland wildlife species where modified production methods are used. However, the examples show that it is hardly possible to implement measures which assist individual species or fulfil the specific requirements of nature conservation without certain financial losses to the farmer. The acceptance of the integration of nature conservation goals into agricultural practice will increase if the farmer can be provided with the means to assess the consequences of each measure. In addition, a co-operation between farmers, consultants, consumers, scientists, and policy makers is necessary in order to promote understanding and emphasise the value of conservation of biological diversity. In addition to financial incentives, close dialogue is necessary to avoid and eliminate misunderstandings and to inform all those concerned of each others needs and wishes. The 'Nature Conservation Farm' serves as a good model of how to meet these challenges.

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