

# LONG TERM BENEFITS OF DIVERSIFIED FORAGE-ORIENTED CROPPING SYSTEMS AS COMPARED TO ROTATIONS BASED MAINLY ON CEREALS OR MAIZE

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## ABSTRACT

The aim of this study is to assess the long term effects of a forage-oriented, versus a maize- and a cereal-oriented crop rotation on the yield potential and soil fertility, as well as the weed, disease and pest development. We report the results after four cropping cycles using silage maize (*Zea mays L.*) in 1994 and winter wheat (*Triticum aestivum L.*) in 1995 as reference crops for all three rotations. Two years of a grass-clover mixture in a five-year rotation showed positive effects with respect to most soil and plant parameters.

## KEYWORDS

Crop rotation, integrated production, sustainability, maize, cereal, forage, soil, weeds, disease.

## INTRODUCTION

Under economic pressure versatile crop rotations are being replaced by simple ones or continuous cropping. However, forage crops (grass-clover mixtures) still play an important role in Swiss arable systems in maintaining soil fertility and regulating crop specific weeds, diseases and pests. Simple rotations have economic advantages if proper plant protection measures are taken. The questions which we would like to answer with the reported field experiment are: what are the long term effects of a forage-oriented crop rotation, if any, and what are the consequences with respect to low input systems such as integrated or organic farming.

## METHODS

Since 1973 we have been comparing the effects of the following **three crop rotations (Table 1)** managed intensively (**is**: generally fall plowing, rotary tiller for seed bed preparation, preventive chemical plant protection and weed control) **and integrated (ip**: generally direct seeding, nitrogen fertilisation reduced, plant protection according to threshold levels, mechanical weed control herbicides only if necessary). The experimental design is a 3x2 randomized bloc with 4 replications. The plots are 12 m wide and 45 m long, which enables the use of farm machinery. The site is located in the Swiss Plateau in Tänikon, near Winterthur (536 m above sea level). The clay soil has a humus content of 5.5% and a pH of 7.5; the annual precipitation is 1200 mm on the average.

## RESULTS

The maize and wheat yields in the two reference years are given in figures 1 and 2. There was a significant positive effect of the forage-oriented crop rotation as compared to the rotations based mainly on maize or wheat. This effect was more pronounced under the integrated than the intensive management system. In the forage rotation soil structure and nitrogen mineralization was also improved. We compensated for the latter by applying a correspondingly lower amount of nitrogen fertilizer. Wheat disease ratings and weed populations were lower. As a consequence weeds could be adequately regulated by mechanical means.

## DISCUSSION

The mentioned superiority of the forage-oriented crop rotation was not observed in the first two rotation cycles (Schwendimann, 1991). The data was, however, consistent with the results of the previous cycle from 1989-1993 (Mediavilla *et al.*, 1995). We conclude that the maize- and the wheat-oriented crop rotations show with time a negative effect on soil fertility require higher inputs of nitrogen fertilizer and pesticides. The forage oriented-rotation would be suitable for organic farming.

## REFERENCES

Mediavilla, V., E. Meister, U. Walther and P. Fried. 1995. Integrated versus intensive management of a long duration diversified crop rotation. *AGRARFORSCHUNG* 2 (6) 231-234.

Schwendimann, F. 1991. Yields of rotation trial "Chaiblen" from 1974 to 1988. *Landwirtschaft Schweiz* 4 (6): 316-319.

**Table 1**

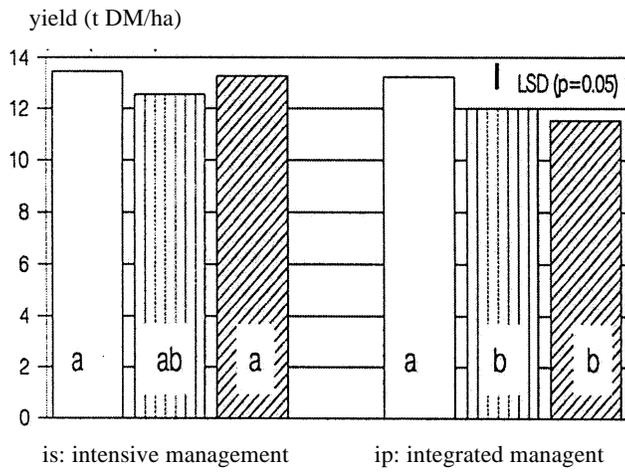
Crop rotations ( 4th cycle since 1973)

year	F: forage 40%	M: maize 60%	C: cereals 60%
1989	silage maize	silage maize	silage maize
1990	winter wheat	winter wheat	winter wheat
1991	grass-clover	grass-clover	winter barley
1992	grass-clover	silage maize	seed rape
1993	potatoes	silage maize	winter wheat
1994 *	silage maize	silage maize	silage maize
1995 *	winter wheat	winter wheat	winter wheat

\* reference years reported in this article

**Figure 1**

Yield of silage maize in 1994 after four cycles of a forage (F), a maize (M) and a cereal (C) oriented crop rotation.



**Figure 2**

Yield of winter wheat in 1995 after four cycles of a forage (F), a maize (M) and a cereal (C) oriented crop rotation.

