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# AN INTEGRATED WEED MANAGEMENT (IWM) MODEL FOR MAIZE CROP

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***Abstract***

*In the new conditions, IWM goal is both to protect plant biodiversity and cultural environment. Promoting such a system requires complex research on: i) weed flora, ii) the climatic conditions, iii) interaction between weeds and crop plants, iv) various control methods, chemical and non-chemical, v) combining control methods for promoting the non-chemical. Very diverse flora from maize crop has reached averages of 16.9 t.ha$^{-1}$, benefiting the rich rainfall years. Naturally weed encroachment of maize produced total biomass and grain to about 50% of that without weeds. Manual and mechanical hoed have minimized the degree of weed. In witness an-hoed weeds produced 1.5-1.7 kg.m$^{-2}$ biomass, competing strongly maize plants. Specific herbicides have maintained levels of weed coverage degrees (WCD) below 20% during the growing season. The comparison of hoeing and herbicides effects showed similar circumstances.*

***Key words:*** *IWM, maize, weeds interaction, hoed system, herbicides.*

## INTRODUCTION

Maize, like other hoed plants have strongly levels of weed encroachment (Berca and Ciorlaus, 1994) regardless of the area where it grows. Relatively large area of nutrition allows the first phases of plants, it is compete by many weed species (Courtney, 1996), favored both by sunlight falling directly on the ground and the moisture which is usually sufficient to seed emergence. Another factor already known is the energy of germination (EG) of grains of different species (Sagar, 1968). Mostly weeds springing up faster than maize, which result in a compact green carpet immediately after sowing (Figure 1).

Of good practice control and correct as of maize weed, commonly is called intercalation of chemical treatment with mechanical hoed (large surfaces) and the manual hoed (small surfaces). This complex of weed control methods could be more accepted part of the rules integrated weed management (IWM) of maize (Auld, 1996; Blair and Green, 1993; Sarpe et al., 1983).

Research conducted both in our country and in other parts (Adamczewski and Radajczyk, 1995; Ionescu et al., 1997; Sarpe et al., 1983) has shown the need to reduce the level of weeds in maize and highlighting the best and suitable chemical strategies.

Figure 1. The weeds encroachment of maize crop

To promote herbicide is to avoid human effort, increasing productivity and reducing the cost price per unit.

Lately, new rules of agro-environmental protection (Mortensen et al., 2000), limiting require exclusive control only by chemical methods (herbicides). Farmers' inclination towards finding new ways to control, as appropriate, possibly cheaper, and their application in complex show that these new trends may meet a specific IWM for each maize crop area. Still be deemed to compile an

IWM as appropriate, necessary studies and experiments us about: ecological nature of interrelations between species (Norris, 1992; Mortensen et al., 2000), the economic damage threshold (Courtney, 1996; Zanin et al., 1994), non-chemical methods of control.

In this paper we present some studies of ecology and weed control methods, whose expression is specifically supported in luvic-soil maize area in the South. It is hoped that the immediate prospect to be able to find common ground that will lead to a possible reduction of chemical treatments. Herbicide will agro-technical complex works of nature, with other non-chemical methods such as biological control of target species. Just as is already known across Europe, our system is practical chemical or organic plant culture and where this whole chemical system is totally excluded. Its share of the entire agriculture is today, however, only a few percentage.

## MATERIALS AND METHODS

In the past 21 years has conducted research on maize weed and weed control methods by several directions. Given the resort area a study on the formation of biomass based weed rainfall regime in which they grew. As important as weed biomass is the structure according to the main categories. Thus, separated annual monocots (AM), perennial monocots (PM), annual dicots (AD) and perennial dicots (PD) and observe their structure. Their evolution over time of known specific variability.

Another line of research aimed at how different degrees of infestation of these weeds influenced the growth and development of maize plants. Interaction studies of weeds and maize plants are needed because justifies making control measures and their intensity. In this regard, weed samples were collected every 11 metric frame moments of maize vegetation from emergence to maturity, with and without weeds and have developed these charts.

One of the ways known and used for weed control in maize is the hoed method. The total hoeing, both on the rows interval and between plants in the row, is done “cleansing” of unwanted species, such as maize plants grow and develop normally. To see the practical importance of total maize hoed is the comparison with an-hoed variant. Yield differences obtained between the two extremes were very apparent in each agricultural year. If the witness was drawn diagram with natural weed deposit total biomass of the species during the growing season.

A specific direction researched covers exclusive use of chemical methods, using herbicides. In order to express the importance of herbicides suing, was analysed expressed influence of weed coverage (WC) of maize crop, on the loss of production. Along with this chart was made comparison of efficacy in weed control with herbicides, expressed as a time during the growing season.

Comparison of different weed control systems becomes important, proving the need for one or the other. On one side is the influence of hoed: the mechanical, the manual and the combination of them, compared with the no-control variant. On the other hand, compares the influences of effective herbicides with complex hoed (manual and mechanical). The results were quite similar.

## RESULTS AND DISCUSSIONS

Given the degree of competition reduced maize with weeds especially in early phases of vegetation (Ionescu et al., 1996; Wilson, 1998), it was considered appropriate to study specific species infestation in natural eco-system conditions of white luvicsoil. Of the many species present in a complex culture (Anghel et al., 1972), most cause damages usually obvious in maize. Interaction between them can be studied separately according to weed be chosen, either all unwanted vegetation carpet. When targeted means of weed control in a crop, it is preferable that weeding be seen especially in its entirely.

Natural weeding maize crop. At maturity the species were harvested with metric frame. Once you have weighted all together, then separation was four categories: annual monocots (AM), perennial monocots (PM), annual dicots (AD) and perennial dicots (PD). In a multi-year study analysed the correlation of weeds that were formed as total biomass in this area where rainfall regime was quite high, including maize vegetation period (Figure 2). The graph shows the direct link between rains that fell in maize vegetation and weed biomass ($r = 0.296$).

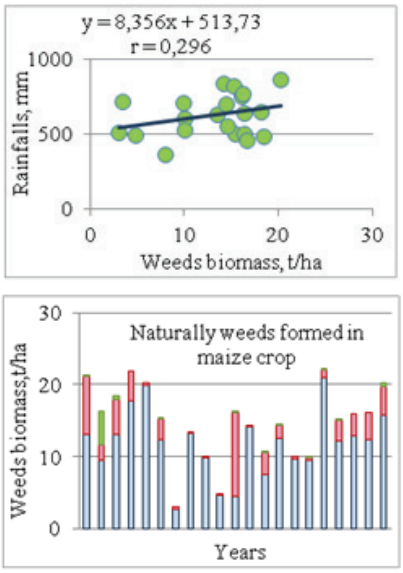


Figure 2. The weed biomass formed by rainfalls and structure: blue-AM, rose-AD, green-PD and PM

Quantitative analysis of annual weeds have quite different values. Smaller quantities were obtained due driest climate, while values of 15-20 t.ha$^{-1}$ d.w. formed in wet years, favourable. Structure between the four categories of annual weeds was also different fluctuating. The structure was found dominance AM type: *Echinochloa crus-galli, Digitaria sanguinalis, Setaria glauca*. AD group followed by the species represented more obvious: *Amaranthus retroflexus, Chenopodium album, Bidens tripartita.* PD *Cirsium arvense* and *Convolvulus arvensis* were counted in some years, and PM *Cynodon dactylon* and *Agropyron repens* appeared sporadically in the form of hearts.

Interaction between weeds and maize plants. Effect of weed on maize plants proved to be harmful (Figure 3). The average maize biomass accumulation showed delays. Lower values were recorded during grain filing substances. Average natural weeding maize reduced accumulation of biomass at about half (1/2) of normal.

Hoed use in weed control. Practice has proved that hoeing maize had provided good conditions for growth and development. Are controlled by hoeing weeds in young stage, taking place and loosening the soil, thereby improving aero-hydraulic regime and nutrition of maize roots. It is usual mechanical hoeing (1-2 times), which completes the one hand (2-3 times). Hoed influence on the production of maize, compared with an-hoed proved to be very obvious. Thus, it was found that regardless of culture year, hoeing maize produced at much higher than an-hoed (Figure 4). Control weeds in accumulated biomass, which at maturity exceeded over 1500 g.m$^{-2}$.

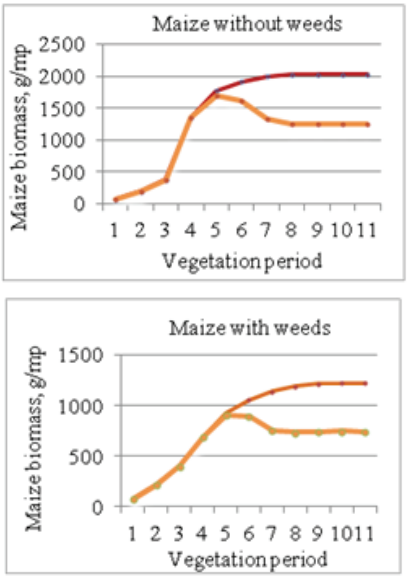


Figure 3. Diagrams of maize plant biomass formation, without and with weeds

Herbicide using in maize crop. Currently it has a real arsenal of herbicide active substances characterized by high degrees of efficiency and selectivity. Both companies industry and research can provide the best and appropriate choice of maize weed control.

To demonstrate the need of herbicide in maize crop, it was made a study on production losses depending on the degree of weed coverage degrees (WCD) crop by weeds (Figure 5).

The results show that only 20% WCD in maize showed 50% loss of production (grains). Nothing maize, both variant treated with herbicides and the witness natural weed encroachment were found specific changes. In March weeds covered culture in a fast pace since the first three weeks, thus absorbing vegetation factors (Berca and Ciorlaus, 1994; Ionescu, 2000). Compared with the control, herbicides have fought and kept fresh ground

100% in the first 6 weeks of growth. Finally WCD stood towards 20%. The situation was due to the emergence and subsequent evolution of re-infestation of weeds and residual effect of herbicides disappearance gentle with agricultural environment.

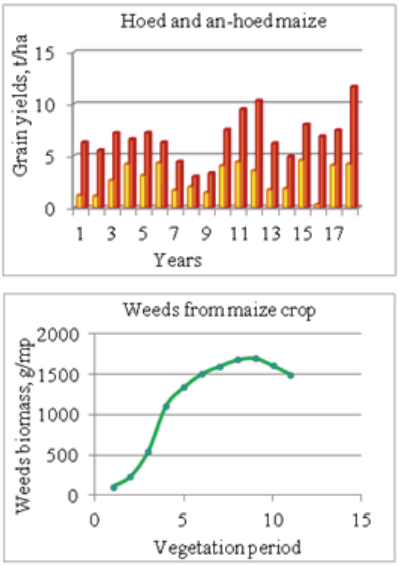


Figure 4. Evolution of maize yields from hoed, mechanical & manual, and no-hoed with an-controlled weeds evolution

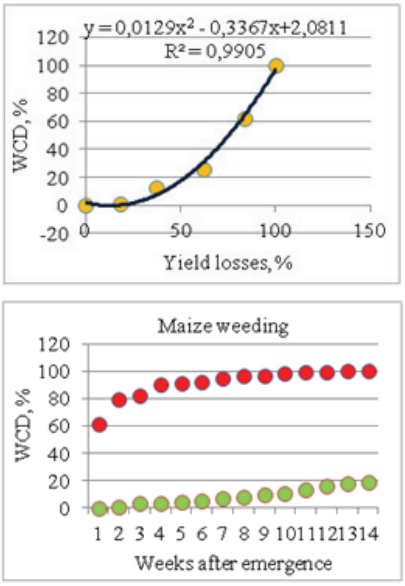


Figure 5. Correlations between weed covered degrees (WCD) with loss of production and WCD with control systems from maize crop

Nonchemical control methods. The most common method of control without herbicides is by hoeing. There are situations where only mechanically or manually, either mechanical or manual. Comparison of these systems with an-hoed showed different effectiveness and grain production (Figure 6). At the same time, on observed that the effectiveness of herbicides was quite equal to mechanical and manual hoed (Gus and Sebök, 1995).

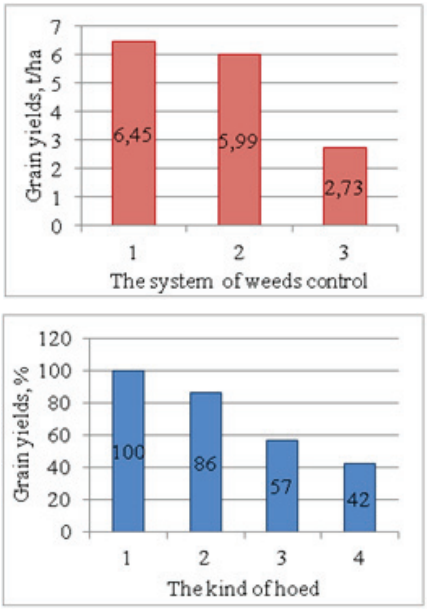


Figure 6. Weed systems control from maize crop (left 1-hoed, 2-herbicide, 3-check plot), and by hoed system (right 1-mechanichal and manual, 2-manual, 3-mechanical, 4-an-hoed)

From the graph it is found that the values were approximately equal (within the limits of error). Thus, if mixed hoed systems were formed on average over 7.1 $t.ha^{-1}$ d.w. grains and 6.9 $t.ha^{-1}$ d.w. maize through herbicide. Witness an-hoed and without herbicide produced an average of 2.1 $t-ha^{-1}$ d.w. grains of maize. The similarity between the two systems: chemical and non-chemical concluded that they are interchangeable (Brown, 1968; Derksen et al., 1993).

## CONCLUSIONS

Maize has weeds every year, with characteristic species at levels considered high. The main causes are: high reserve of seeds in the soil and

very low power to compete with maize weeds. Apply an appropriate IWM will control weeds until acceptable limits. The multi studies demonstrated a positive correlation with rainfall regime and the formation of different weed biomass due to drought or rainy regime. Thus, total weed biomass ranged from 3.0 $t.ha^{-1}$ d.w. and 22.4 $t.ha^{-1}$ d.w. Weeds structure was as follows: 80% annual monocots AM, very competitive with maize, 17% annual dicots (AD) and 3% perennial dicots (PD) and perennial monocots PM.

Study the interaction between weeds with maize plants showed how losses occur in total biomass and grain level. Media of competition show reduction in biomass present in 50% of normal maize. There are cases in some years when reduction can reach below 10%.

Between hoeing maize and an-hoed were obtained significant differences. Mechanical and manual hoed not only provides sufficient control of weeds, and improved physical and chemical statement of environment. Weeds of witness an-hoed constantly accumulated biomass, with meant maturity over 15 $t.ha^{-1}$ d.w.

In the IWM, herbicides have been and remain the main means of weed control in maize crop. Expressed weeding coverage degrees (WCD) was maintained at very low levels, total not by herbicides. WCD only 20% resulted in maize production losses of 50%, which demonstrated the need for control measures, including herbicides.

Effectiveness of non-chemical and chemical methods by hoeing was located approximately at the same level, so they can be replaced. In the future, by combining them, or otherwise, could get as good results, creating the conditions to reduce the amounts of active chemical ingredients, a situation consistent with the new European requirements.

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