UDC 631.67:632.954:633.15
*Original scientific paper*

# EFFECTS OF THE IRRIGATION AND HERBICIDE APPLICATION ON SEASONAL CHANGES IN THE MAIZE WEED COMMUNITY

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Simić Milena, Lidija Stefanović and Borivoj Šinžar (2004): *Effects of the irrigation and herbicide application on seasonal changes in the maize weed community.* - Acta herbologica, Vol. 13, No. 2, 443-448, Beograd.

Fresh mass (g $m^{-2}$) of 10 most distributed weed species was analysed under rainfed and irrigation conditions on herbicide treated areas, was done in spring and summer. Fresh mass of investigated weed species was, on the average for all years higher in summer than in spring. The highest fresh weed mass was detected in 1998 under conditions of both rainfed and irrigation. Only 1996 was characterised by a satisfactory effect of the soil herbicides application under both water regimes due to a favourable precipitation distribution.

*Key words*: maize; weed species; fresh mass; seasonal changes

## INTRODUCTION

Climatological changes in recent times have been adversely affecting efficiency of herbicides applied to the soil after maize sowing, and by it, on the level of planned yields (PATTERSON, 1995.). Irrigation is the only efficient way to surpass the problem of water deficit. Irrigation activates soil nutrient reserves, contributes to better utilisation of incorporated mineral substances and, in general,

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makes the maize growing system an intensive one that favours the crop, but also weeds (KOVAČEVIĆ, 2003). The distribution of certain groups of weeds in maize varies due to, among other things, efficiency of the applied herbicides, and differs under irrigation conditions from rainfed conditions (STANOJEVIĆ *et al.*, 2000).

In recent times, the application of herbicides during the growing season of maize has become more actual. However, the successful application of these herbicides depends on the good knowledge of the weed community composition and developmental stages of both, weeds and crops. Therefore, the aim of the present study was to analyse the herbicide effects on maize weediness in the seasonal dynamics depending on irrigation.

## MATERIAL AND METHODS

The composition and seasonal dynamics of the weed community under conditions of rainfed, irrigation and herbicides application were studied on slightly calcareous chernozem in the experimental field at Zemun Polje during the period 1996-1999. The treated variant included the following herbicide combination: atrazin+metolahlor, in the amount of 1.0 and 2.88 l a.i. $ha^{-1}$, after sowing and prior to emergence. Watering was done when soil moisture approached the lower level of easy available water which for slightly calcareous chernozem amounts to approximately 75% of field water capacity. In 1999 there was no need to water. Weed sampling from was done in order to estimate fresh mass of each weed species in spring and in summer. The present study included analyses of fresh mass of ten most distributed weed species. The average values of weed fresh mass were calculated for each investigation year on the basis of four replicates.

Meteorological conditions differed over years of investigation from one another and from a long-term average. Hence, mean monthly air temperatures in 1996 and 1997 were at the level of the long-term average (11.0 and 12.1 °C), while they were significantly higher (13.2 and 13.0 °C) in 1998 and 1999. In regard to precipitation, the sums in all investigation years were higher than the long-term average for the investigation location.The only exception was a rather dry year of 1998.

## RESULTS AND DISCUSSION

The application of herbicides after sowing had good results in all years except 1998 (Tables 1 and 2). The best results due to favourable precipitation distribution were registered in 1996. The effect of the herbicides application was completely missed in the exceptionally dry year of 1998. The greatest fresh mass in the spring aspect for all years was registered on the average in the perennial species *Sorghum halepense* (70.14 g $m^{-2}$).

*Table 1. - Fresh mass of weed species (g m$^{-2}$) most distributed on the treated area under rainfed conditions in the spring aspect*

| Weed species | Years | | | | |
|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | $\bar{X}$ |
| *Sorghum halepense* (L.) Pers. | 29.97 | 1.38 | 77.00 | 172.20 | 70.14 |
| *Convolvulus arvensis* L. | 16.97 | 71.60 | 47.27 | 67.60 | 50.86 |
| *Amaranthus retroflexus* L. | 2.90 | 9.88 | 167.10 | 1.70 | 45.39 |
| *Chenopodium hybridum* L. | 1.50 | 35.20 | 121.43 | 2.92 | 40.26 |
| *Calystegia sepium* (L.) Br. | - | 3.08 | 149.75 | - | 38.21 |
| *Cirsium arvense* (L.) Scop. | 5.10 | 37.85 | 29.12 | 34.60 | 26.67 |
| *Datura stramonium* L. | 9.97 | 11.15 | 8.93 | 6.18 | 9.06 |
| *Solanum nigrum* L. | 6.67 | 8.73 | 20.85 | 0.15 | 9.10 |
| *Hibiscus trionum* L. | - | 1.18 | 37.02 | 0.95 | 9.79 |
| *Amaranthus albus* L. | 1.10 | 0.55 | 24.47 | - | 6.53 |
| Total | 72.18 | 180.60 | 682.94 | 286.30 | 305.50 |

Fresh mass of most distributed weed species under rainfed conditions was, on the average for all years, lower in the spring (305.50 g m$^{-2}$) than in the summer estimation (503.33 g m$^{-2}$). The greatest fresh mass per a species was registered in *Calystegia sepium* (73.96 g m$^{-2}$) while fresh mass of other weed species was smaller due to the competition between the crop and weeds(Table 2). Similar to results obtained for rainfed under irrigation conditions, the total fresh mass of inestigated weeds was greater in the summer (683.05 g m$^{-2}$) than in the spring aspect (539.25 g m$^{-2}$). The greatest total weed fresh mass (787.20 g m$^{-2}$) was detected in 1998, due to dry conditions. The weed species *Chenopodium hybridum* and *Cirsium arvense*, on the average for four years, the most distributed over the treated area under irrigation conditions in the spring aspect (Table 3). Weed fresh mass on the irrigated areas was greater in the summer than in the spring aspect over all years of investigations (Table 4).

*Table 2. - Fresh mass of weed species (g m$^{-2}$) most distributed on the treated area under rainfed conditions in the summer aspect*

| Weed species | Years | | | | |
|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | $\bar{X}$ |
| *Calystegia sepium* (L.) Br. | - | 1.30 | 294.55 | - | 73.96 |
| *Amaranthus retroflexus* L. | 63.07 | 4.87 | 203.48 | 5.43 | 69.21 |
| *Convolvulus arvensis* L. | 21.87 | 103.55 | 63.72 | 84.47 | 68.40 |
| *Sorghum halepense* (L.) Pers. | 36.95 | 28.10 | 58.72 | 133.37 | 64.28 |
| *Chenopodium hybridum* L. | 14.58 | 60.62 | 140.03 | 16.58 | 57.95 |
| *Solanum nigrum* L. | 36.42 | 11.37 | 125.57 | 16.28 | 47.41 |
| *Cirsium arvense* (L.) Scop. | 61.44 | 29.75 | 42.77 | 28.72 | 40.67 |
| *Datura stramonium* L. | 37.67 | 44.65 | 32.15 | 1.22 | 28.92 |
| *Amaranthus albus* L. | 37.76 | 2.00 | 70.90 | - | 27.66 |
| *Hibiscus trionum* L. | 7.84 | 8.95 | 81.43 | 1.18 | 24.85 |
| Total | 317.60 | 295.16 | 1113.32 | 287.25 | 503.33 |

*Table 3. - Fresh mass of weed species (g m$^{-2}$) most distributed on the treated area under irrigation conditions in the spring aspect*

| Weed species | Years | | | | |
|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | $\bar{X}$ |
| *Chenopodium hybridum* L. | - | 234.55 | 144.87 | 2.28 | 95.43 |
| *Cirsium arvense* (L.) Scop. | 31.70 | 106.60 | 11.82 | 222.25 | 93.09 |
| *Sorghum halepense* (L.) Pers. | 23.92 | 87.75 | 60.08 | 196.50 | 92.06 |
| *Amaranthus retroflexus* L. | 2.58 | 167.05 | 177.97 | 2.00 | 87.40 |
| *Convolvulus arvensis* L. | 9.15 | 31.68 | 84.92 | 86.92 | 53.17 |
| *Datura stramonium* L. | 0.20 | 87.17 | 93.90 | 3.47 | 46.18 |
| *Calystegia sepium* (L.) Br. | 14.50 | - | 86.93 | - | 25.36 |
| *Solanum nigrum* L. | 1.57 | 34.40 | 59.17 | 0.70 | 23.96 |
| *Amaranthus albus* L. | - | 3.72 | 49.52 | - | 13.31 |
| *Hibiscus trionum* L. | 0.42 | 0.73 | 18.02 | 18.02 | 9.30 |
| Total | 84.04 | 753.60 | 787.20 | 532.14 | 539.25 |

*Table 4. - Fresh mass of weed species (g m$^{-2}$) most distributed on the treated area under irrigation conditions in the summer aspect*

| Weed species | Years | | | | |
|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | $\bar{X}$ |
| *Sorghum halepense* (L.) Pers. | 403.07 | 136.50 | 104.78 | 52.70 | 174.26 |
| *Amaranthus retroflexus* L. | 42.23 | 82.17 | 237.20 | 5.20 | 91.70 |
| *Convolvulus arvensis* L. | 96.27 | 72.37 | 101.78 | 56.37 | 81.70 |
| *Chenopodium hybridum* L. | - | 173.58 | 119.68 | 6.97 | 75.06 |
| *Calystegia sepium* (L.) Br. | 128.35 | - | 163.90 | - | 73.06 |
| *Cirsium arvense* (L.) Scop. | 32.67 | 101.02 | 24.88 | 43.48 | 50.51 |
| *Solanum nigrum* L. | 23.05 | 65.00 | 170.07 | 5.62 | 65.94 |
| *Datura stramonium* L. | 20.02 | 17.50 | 120.70 | - | 39.44 |
| *Hibiscus trionum* L. | 21.03 | - | 46.6 | - | 16.91 |
| *Amaranthus albus* L. | 4.80 | 12.27 | 36.15 | 4.20 | 14.35 |
| Total | 771.49 | 660.41 | 1125.74 | 174.54 | 683.05 |

Weed species *Sorghum halepense* and *Amaranthus retroflexus* were, on the average for four years, the most distributed over the irrigated area in the summer aspect.

Based on obtained results it can be observed that fresh mass of the most distributed weed species in the areas under rainfed conditions was greater in the summer than in the spring estimation in all investigation years in spite of the growth and development of maize that had a competitive effect on weeds In the irrigated variant, the total fresh mass was even greater in the summer than in the spring aspect of investigation years. In accordance with the stated, due to often occurrences of dry years under our agroecological conditions, the additional application of herbicides during the growing season of maize might be advantageous (RADIVOJEVIĆ *et al.*, 2002 ). Considering changes of the maize weed community under conditions of rainfed and irrigation, such application of herbicides would be justifiable. However, it should not be forgotten that the application of herbicides after emergence of weeds and maize, beside being beneficial, is not always safe for the crop (BUCHANAN *et al.*,1990; STEFANOVIĆ and STANOJEVIĆ, 2000).

## CONCLUSION

Fresh mass of the most distributed weed species on the herbicide treated area was on the average for all years lower in the spring than in the summer estimation under both water regimes.

The total fresh mass of the most distributed weed species on the herbicide treated area was greater in the irrigated than the rainfed variant in both aspects of the weed community in almost all years of investigations.

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Recieved March 25, 2004
Accepted April 10, 2004

# EFEKAT PRIMENE NAVODNJAVANJA I HERBICIDA NA SEZONSKE PROMENE KOROVSKE SINUZIJE KUKURUZA

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I z v o d

Ispitivana je sezonska dinamika korovske sinuzije na površini sa prirodnim vodnim režimom i navodnjavanjem, u uslovima primene herbicida. Analizirana je sveža masa (g $m^{-2}$) deset najzastupljenijih vrsta korova metodom slučajnih kvadrata, u proleće i u leto. Sveža masa korova na tretiranoj površini u uslovima prirodnog vodnog režima i navodnjavanja, na varijanti sa primenom navodnjavanja u poređenju sa uslovima prirodnog vodnog režima. Najveća ukupna sveža masa korova utvrđena je u 1998. godini u oba vodna režima. U ovoj godini, zbog sušnih uslova u vreme setve kukuruza, primena herbicida nije imala zadovoljavajući efekat. Jedino je u 1996. godini, zbog povoljnog rasporeda padavina, u oba vodna režima, primena zemljišnih herbicida imala odgovarajući efekat.

Primljeno 25. marta 2004.
Odobreno 10. aprila 2004.