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EFFECT OF IRRIGATION WATER POLLUTED WITH DIFFERENT CHEMICALS ON CULTIVATED PLANTS I. WEED KILLING EFFECT OF CHLORBROMURON AND THAT OF HERBICIDES MIXTURES ON SPECIES GRAMINEAE

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Abstract

Examinations were carried out by pre- and postemergent treating of barley, rye and oat seedlings with chlorbromuron and herbicides mixtures. These control plants were also used in field experiments carried out in culture pots. The concentration of agents was to show the possible pollution of natural and irrigation waters. Different development of seedlings was observed and owing to the field experiments carried out in culture pots the agents' period of effectiveness could have been established as well.

Introduction

The third main thesis of the economy of water-supply is irrigation, estimated watermass of which is goind to be 2.7—3.7 milliard m^3 by 1985. Estimated water-mass of fishing ponds is going to be 0.8 milliard m^3 by then. This is the very water-quantity, the slowly-decomposing organic compound pollution of which is to be minimised. Irrigation and chemical weed-killing are connected by running water and system of canalisation from the view-point of canalisation. At chemical weed-killing preventation has special importance, being necessary in a given period of cultivation and followed sometimes by disadvantageous water-supply factors.

Preemergent utilisation of weed-killers concides with the time of seeds' sowing or planting. Treatment of plants on different stages of development is known as the herbisides' postemergent utilisation which can be repeated several times within a cultivation period. Their utilisation of non-convenient concentration washing-out of the soil followed by the weeds' devastating effect may cause significant damages in the cultivated-stand of other territories. Our examinations were carried out with chlorbromuron and weed-killing mixture. These agents' effect on barley, rye and oat seedlings was examined in pre- and postemergent treatments. The same species were used in our field-experiments as well. During laboratory examinations except for the plants' development-parameters was determined the total soluble protein content and was measured the peroxidase enzyme-activity, which is a sensitive signal for damage. Agents' life-span of efficacy was established on the basis of culture-pot experiments.

Materials and Methods

Germination was carried out on 23°C in dark in breeding solution containing agents — at preemergent treatment. Tap-water control plants and the treated ones were grown among the same circumstances. At postemergent treatment 4-day-old seedlings were moved from dark into a light-thermostat (about 700 lux) and during their further growth a 14 hour light-period was changed with 8 hour dark one. Plant-physiological changes were observed by following some parameters, so the control plants' soluble protein content could be decided according to LOWRY at al. (1951), and their peroxidase enzyme activity by COLOWICK's and KAPLAN's method (1955).

During field experiments in culture pots herbicides (0.5 g clorbromuron and 3 ml/l herbicides mictures) were carried during sowing preemergently and postemergently on diplyllouse. Experiments were repeated 3—5 times.

Results and discussion

Effect of preemergently used clorbromuron on barley, rye and oat seedlings.

Preemergent treatment was examined on the 5th day of germination carried out in dark. 2 mg/l and 4 mg/l concentration of clorbromuron or its 5 times more amount were established not to inhibit the seddlings' development, even slightly prometed the root's and stem's growth in length at all the three control plants (Table 1).

Table 1. *Effect of preemergently used clorbromuron treatment on the growth of 5-day-old seedlings and on the dry-material content of plants*

Sortes	Agent's concentration	Length in mm. shoot	Length in mm. root	Dry-material content in % shoot	Dry-material content in % root
Barley	2 mg/l	77	122	7.57	7.7
	4 mg/l	80	116	7.52	7.3
	10 mg/l	84	128	7.57	6.35
	20 mg/l	86	125	7.95	6.85
	control	73	118	7.3	7.22
Rye	2 mg/l	67	106	9.05	10.4
	4 mg/l	65	90	9.4	8.2
	10 mg/l	70	119	8.12	7.3
	20 mg/l	68	117	8.2	6.85
	control	65	112	8.48	6.9
Oat	2 mg/l	52	73	7.1	5.58
	4 mg/l	58	80	6.72	5.75
	10 mg/l	55	79	7.75	8.5
	20 mg/l	56	70	7.02	7.0
	control	54	72	7.4	6.8

When examining the dry-material content, lower concentrations of clorbromuron resulted higher values in the root and shoot of the control-plant. At higher concentrations dry-material contents were under the control values. Examining peroxidase enzyme activity of the first leaf's level, values differed from the control ones in the shoot's development (Table 2).

Table 2. *Effect of clorbromuron treatment on the peroxidase enzyme activity of the first leaf's level of the 5-day-old seedling*

Sortes	Agent's concentration	Peroxidase enzyme activity EU*g* fresh weight
Barley	10 mg/l	181
	20 mg/l	161
	control	175
Rye	10 mg/l	126
	20 mg/l	157
	control	177
Oat	10 mg/l	127
	20 mg/l	125
	control	141

After the tratment rye and oat showed a decrease in enzyme-activity. The barley's reactivity is much the same with that of the rye according to the control values. Neverthless the two species showed a different reaction after the treatment; at lower concentration the barley's activity increased, while that of the rye and oat positively decreased. Urea-type herbicides have a good transportation in the plant, their degradation and transformation may occure, their effect on peroxidases is secondary, but shows the whole metabolism's involvment. Effect of preemergently used weed-killing mixture on barley, rye and oat seddlings.

The preemergently used weed-killing mixture inhibited the shoot's and root's development of barley-seedlings in comparison with the control ones. When determining the peroxidase-activity of 5-day-old barley seedling's first leaf-level, increase could be observed in comparison with the control. There was no significant difference in the plant's ascorbic-acid content. The tratment had an inhibitory effect on the growth of rye -seedlings. The peroxidase, activity and ascorbic-acid content increased as well. In the case of oat seedlings the effect on the plant's condition and dry-material content was similar to that of the two other controls. Decrease of peroxydase-activity and ascorbic-acid content in this case was the most expressed (Table 3).

Effect of postemergent treatments; Barley, postemergently treated with weed-killing mixture didn't show any divergence in growth and development as compared to the control-plant. Values of dry-material accumulation and peroxidase-activity hardly changed. Owing to the fast metabolism the quantity of ascorbic-acid increased in comparison with the plants treated with lower concentration. Weed-killing effect of the mixture with 2.5 ml/l concentration was similar to that of untreated control ones

As an effect of postemergent treatment 10-day-old rye-plants were significantly damaged. Leaves had started to dry and the plants died soon. The quantity of ascorbicd-acid increased in the case of examined concentrations. Activity of peroxidase-enzyme increased by 50% when being treated with higher concentration.

The mixture's weed-killing effect was well-tolerated by oat-plants. The shoot-growth of 15-day-old plants was only slightly inhibited. There were no significant changes in the peroxidase enzym activity and in the quantity of ascorbic-acid. The results of experiments are shown in Table 4.

Table 3. *Data of Gramineae species preemergently treated with weed-killing mixture and germinated in dark*

Sortes	Agent's concentration	Shoot Length in mm	Shoot Dry-material in %	Shoot AA γ/g fresh weight	Shoot PO EU/g fresh weight	Root Length in mm	Root Dry-material in %	Root AA γ/g fresh weight	Root PO EU/g fresh weight
Barley		71	7.86	207	126	78	9.37	—	—
Rye	5 ml/l	64	9.4	308	208	56	15.00	—	—
Oat		149	6.5	347	244	48	6.8	—	—
Barley		67	7.95	203	137	82	7.76	—	186
Rye	10 ml/l	71	10.00	381	251	70	14.70	—	236
Oat		135	5.1	314	259	54	6.3	—	240
Barley		87	7.4	211	123	117	6.23	—	195
Rye	control	92	9.3	364	249	108	6.4	—	197
Oat		196	4.4	371	316	106	6.1	—	161

Table 4. *Data of cereals postemergently treated with herbicides-mixtures*

Sortes	Agent's concentration	Length in mm	Shoot and first leaf's level: Dry material in %	AA γ/g fresh weight	PO EU/g fresh weight
Barley					
10-day-old	5 ml/l	104	10.78	441	120
	2.5 ml/l	115	9.98	279	142
	control	139	9.56	301	153
Rye					
10-day-old	5 ml/l	96	10.00	396	412
	2.5 ml/l	96	10.2	465	481
	control	113	9.7	336	451

Account of field-experiments in culture-pots; Plants of field-experiments were given only natural precipitation after herbicide-treatment. Barley-plants had germinated but by the 23th day after the preemergent treatment died. Similar results were obtained by postemergent treatment with chlorbromuron. Pre- and postemergent treatment with clorbromuron. Pre- and postemergent treatments were even less tolerated by rye and oat and these plants died as well.

Culture-post were used repeatedly after dying till we could get plants of the same condition as the control ones. In this way it could have been established that the effect of chlorbromuron had been unchaged until the 62nd day after the treatment.

The weed-killing mixture's effect on the Gramineae control-plants was similar to that of the chlorbromuron, while our experiments with other herbicides, for example using 2,4-dichloro-phenoxy-acetic-acid, healthy-developing plants were produced on the 20—23rd days after treatment.

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The 3-(3-chlor-4-bromfenil)-1-metoxi-1-metilurea, the so-called chlorbromuron's effect was examined on different cereals. Urea-type herbicids showed divergent fitotoxic effect on each species during postemergent treatments. Results of preemergent treatments and culture-pot field experiments even during germination noted different chemical-reactivity. The same effect was observed by WESSEL and VAN DER VEEN (1956) when demonstrated the leaf's early loss of ability of binding carbon-dioxide after the treatment with urea-type chemicals.

Flavonmononucleotid is able to defeat the material's disconnecting role within fotosystem. This later interaction provides possibility for experiments to establish the level of detoxication within plant (SWEELSER 1963).

Further, as continuation of field-experiments, having known the herbicides' time of decomposition, minimising of disinfectant spray is aimed — which is important from environmental and economical view-points — as it has been done in the case of some cereals and herbicides (SCHALLER 1977, EGGER at al. 1978).

Experiments on utilization of weed-killing mixture have pioneer character.

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Különböző anyagokkal terhelt öntözővíz hatása termesztett növényekre.

I. A klór-brómuron és a keverék gyomirtó hatása a Gramineae fajokra

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Kivonat

A 3-(3-klór-4-brómfenil)-1-metoxi-1-metilurea, röviden a klórbrómuron hatását vizsgáltuk gabona fajokon. Az urea típusú herbicidek fajonként eltérő fitotoxikus hatását tapasztaltuk a posztemergens kezelések során. A preemergens kezelések és a szabadföldi tenyészedényes kísérletek eredményei a már csírázáskor jelentkező eltérő vegyszerérzékenységre hívták fel a figyelmet. Eredményeinkkel egyező hatást figyeltek meg Wessel és Van der Veen (1956), amikor rámutattak arra, hogy a levél már igen hamar veszít a széndioxid megkötő képességéből az urea típusú vegyszerekkel történő kezelést követően. A fotoszisztémen belüli szétkapcsoló szerepet az anyagnak a flavinmononukleotid kivédeni képes. Ez utóbbi kölcsönhatás alapján kísérletek állíthatók be a növényen belül történő detoxikáció mértékének a megállapítésára (SWEELSER, 1963). Kísérleteink ily irányban történő folytatását tervezzük.

Uticaj navodnjavanja na gajene kulture različitim materijama opterećenom vodom

I. Uticaj klor-bromurona i herbicida na Gramineae

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Abstrakt

Autori su uticaj klor-bromurona (3-(3-klor-4-bromfenil)-1-metoxil-1-metilurea) izučavali na žitaricama. Konstatovano je selektivno fitotoksično dejstvo nakon postemergentne primene herbicida na bazi uree. Preemergentna tretiranja kao i rezultati eksperimenata u sudovima gajenih biljaka u prirodnim uslovima, pokazali su selektivnu osetljivost već pri klijanju. Ovi rezultati se podudaraju sa postignutim efektima Wessel-a i Van der Veen-a (1956), koji su ukazali na činjenicu da listovi veoma brzo gube moć vezivanja CO_2 nakon tretiranja herbicidima na bazi uree. Flavinmononukleotid je u stanju da spreči ulogu razdvajanja materija unutar fotosistema. Na osnovu ove uzajamne uslovljenosti moguće je u samoj biljci utvrditi stepen detoksikacije eksperimentalnim putem (Sweelser, 1963). Naša dalja istraživanja predvidjena su u ovom pravcu.

ВЛИЯНИЕ ЗАГРЯЗНЕННЫХ ПОЛИВНЫХ ВОД НАГРУЖЕННЫХ РАЗЛИЧНЫМИ ВЕЩЕСТВАМИ НА ВЫРАЩИВАЕМЫЕ РАСТЕНИЯ. П ВЛИЯНИЯ МОТОРНОГО МАСЛА И ДРУГИХ СОЛЕЙ 2,4-Д НАТРИЯ

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Резюме

В опытах преемергентным способом использовали одновременно 2,4-Д натриевую соль с моторным маслом для выращивания ячменя, тыквы и огурцов. Установили, действие разлинных способов на процесс прорастания семян у однодольных и двухдольных растений.

Масло влияет на процесс проростания семян, — вода проникает через семядоли не задерживается маслом, в результате, чего, семя набухает, причем 2,4-Д основной гербицид- как гормоновлиятельное вещество задерживает развитие зародыша и производит определенные изменения.

Увеличенный обьем аскорбиновой кислоты постепенная активизация пероксида, указывают на ускорение обмена веществ, что особо проявляется у тыквы.

У огурцов, проявление ранных поврежденний указывает на неспособность содержания изменений фенола. У сильно поврежденных растений редко увеличивается количество аскорбиновой кислоты.

У зародышей огурцов, это влияние в ранних стадиях еще не проявляется, но у 7-дневных поростков зародышей тыквы изменение уже ясно проявилось (Селл 1980).

В семействе злаковых морфологические и структурные изменения в прорастании семян очень подобные. Вес свежего эмбриона увеличится на 120% в истечении 20—30 минут после приема воды (Маркуш 1966). Итак стало ясно, что вредное влияние моторного масла уже проявляется при первых шагах проростания семян.