

PHASE OUT OF METHYL BROMIDE IN PRODUCTION OF TOBACCO SEEDLINGS IN CROATIA*

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1. INTRODUCTION

Tobacco is economically important plant in Croatia (Budin et al., 1994). The main type of tobacco in Croatia is Virginia flue-cured tobacco, which is grown on about 6000 hectares in northern Croatia (Tur{i} et al., 1999). In this region, around 2000 farmers are involved in the tobacco production. The average size of the family farm is 3 - 5 hectares. They produce about 12 000 tons of dry leaves of tobacco per year.

Methyl bromide has been used in Croatia for more than forty years, in the control of pests, nematodes, weeds and soil pathogens in tobacco transplant production (Bu`an-i}, 1996). Methyl

bromide is not manufactured in Croatia, and is therefore imported mainly from the USA and Israel, which accounted for a total import of around 30 tons.

The experiments have been started to find the most suitable treatment in seedbeds between solarization plus biofumigation and floating tray system (non-soil cultivation), all in combination with an integrated pest management program to improve the conventional way of production of plants in seedbeds treated with methyl bromide.

2. MATERIALS AND METHODS

The testing alternatives are solarization plus biofumigation and non-soil cultivation, in combination with an integrated pest management program. A blank control and methyl bromide fumigation are also used as comparison.

The experiments were conducted in seedbeds of 10 m², covered with plastic sheet and floating tray beds of 3 m² in the first year.

There were five treatments in the experiments:

1. Control
2. Methyl bromide applied in the conventional way (45.5 g/m²)
3. Dazomet (Basamid - 50 g/m²)
4. Floating tray system
5. Solarization / biofumigation

Traditional treatment of seedbed with methyl bromide

This is a traditional system, where methyl bromide at a rate of 45.5 g/m² is applied over the well-prepared soil in seedbed. The soil is covered with plastic sheet in duration of seven days. Thereafter, the plastic sheet is removed and sowing starts using 1 g of seeds / seedbed 10 m².

Treatment of seedbed with Dazomet (Basamid)

Dazomet, fumigant, was used in seedling nurseries and applied to the well prepared soil in the seedbed at the beginning of September at a rate of 50 g/m² Basamid and incorporated 20 cm deep in the soil.

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Bio-fumigated seedbed

Seedbed for biofumigation was prepared at the end of September. Fresh sheep manure in a rate of 5 kg/m² was added and incorporated up to 20 cm deep in the seedbed soil. After the sheep manure application, the seedbed was covered with plastic sheet until the sowing date.

Floating tray system

In the expanded polystyrene trays (0.516 x 0.303 x 0.059 m) with 209 cells commercial substrate or experimental mixtures was poured, the seeds were sown and trays were placed to float on a water surface. The size of the pool was 0.92 x 10.35 m. Water was filled till the depth of 0.12 m. The bottom of the pool was covered with the double black plastic sheet. The electro-conductivity (EC) of the water was measured before

pouring in the pools.

1200 l of water was poured in the pools with dimensions of 0.92 m x 10.35 m x 0.15 m and 1.2 l of fertilizer N-P-K-Mg (10-5-10-2) + microelements, 10 ppm of Ridomil, 10 ppm of Previcur and 10 ppm of Mythos were added.

Pools with water and trays were covered with thermo selective Lutrasil sheet.

At the same time, thermometers for air and water measurements were placed in the plastic house and for measuring of air and soil temperature outside plastic house.

Potassium permanganate solution was used in the water to prevent algae development.

The seedlings were clipped two times. Before transplanting all tobacco was sprayed with Ridomil.

3. RESULTS AND DISCUSSION

3.1. Chemical alternatives

Dazomet (Basamid), a chemical soil sterilizer used in seedling nurseries, is a technically feasible chemical alternative to methyl bromide. It is effective against nematodes and weeds, with the advantage of being non-persistent in the environment and is not to be an ozone depleting substance. However, in conducting the trials, some phytotoxicity on plants was detected. At

Tobacco Institute, the area treated with Dazomet resulted in lower seed germination. In average, 380 tobacco seedlings / m² in the first year, and 115 tobacco seedlings in the second year (Table 1) developed in the treated bed.

Dazomet (Basamid in a rate of 50 g/m²) was incorporated in the soil and covered with plastics at the end of September.

Table 1 Number of tobacco seedlings and weeds per m² on plots disinfested with soil fumigants and control, 2000-2001

Treatments	Number of tobacco seedlings / m ²		Number of weeds / m ²	
	2000	2001	2000	2001
Control	156	193	203	215
Dazomet	310	269	1	3
Methyl bromide	496	530	3	2

The plot treated with methyl bromide, in the season 2000-2001 produced in average more seedlings per plot (between 496 and 530 seedlings / m²), compared to Dazomet.

Dazomet controlled most of the weeds very successfully. In average, only 2 weeds / m²

were observed in the treated plot.

Treatment with 50 g of Dazomet / m² perfectly controlled weeds. However, this year there was also phytotoxicity and the number of seedlings was reduced.

3.2. Seedbeds with no treatment (control)

Large number of weeds developed in the area in seedbeds without treatment (control), reducing tobacco seedlings development significantly. A large number of weeds (203-215/m²) that initially developed in seedbeds, impaired seed germination, and reduced the number of seedlings available for transplantation. In seed-

beds there was no weed control, and the large number of weeds developed totally reducing seedling development.

Weed density was very high at control and tobacco plants had a small stem, and it was impossible to use planting machine.

Table 2 Height of plants, length of roots and stem diameter

	Height of plants (cm)	Roots (cm)	Stem diameter (mm)
Control	6.3	4.4	2.6
Dazomet	14.1	5.1	4.1
Methyl bromide	16.4	6.3	3.8

3.3. Biofumigation

Fresh sheep manure in a rate of 5 kg / m² was added at the beginning of September on the plots. Weed control was very poor. Tobacco seedlings (170 / m²) developed high narrow leaves and density was reduced. Weed density was very high and tobacco seedlings had a small stem. They developed more in width than in height and

because of this, it was impossible to use planting machine.

In our opinion, manure for such type of disinfections should be applied earlier, when higher temperatures could be achieved under plastic (O{trec, 1993).

3.4. Floating tray system

Floating tray system produced the most uniform seedlings, and the highest percentage of useful seedlings compared to the other treatments (Hamel, 2000, Nicolas, 1999, Smith, 1999,

Tur{i}, 2000, Sanz, 2001).

Tobacco substrate imported from Germany was mixed with 30 % of perlite.

Table 3 Number of sown seeds, off-shoots and plants for planting (m²), length of plants and roots, 2000/2001.

Location and method	No. of sown seeds (m ²)	No. of off-shoots (m ²)	No. of plants for planting (m ²)	Length of plants (cm)	Length of roots (cm)
Control	1300	860	175	6.3	4.4
MeBr	1300	1010	513	16.4	6.3
Basamid	1300	650	290	14.1	5.1
Float system	1339	1203	1003	17.2	7.1
Biofumigation	1300	680	170	10.1	5.1

The best developed seedlings were the one that were grown in floating trays and the substrate was for tobacco. Faster off-shooting and better development of seedlings was if tobacco substrate was mixed with vermiculite and perlite (Sanz, 2001; Tur{i} et al 1999).

The seedling stress caused by transplantation from the seedbed to the field was less pronounced in the floating system, compared to the other alternatives tested. This fact is due to the portion of substrate that remains adhered to the roots, protecting them against the water stress

that normally occurs after transplanting, especially in 2000 because of the dry and warm soil during May.

Through UNIDO Project, Tobacco Institute Zagreb has decreased usage of methyl bromide in "Croatian tobacco" by 90 %.

The substitution of methyl bromide with the usage of floating tray system has positive effect on ozone layer protection, prevention of Br leaching into ground water and increase of yield and quality of produced tobacco in Croatia.

4. CONCLUSIONS

1. The results of the two years experiment have shown that in our pedoclimatic conditions, seedlings of good quality can be produced on the plots where methyl bromide was used or with floating tray system as an alternative for the methyl bromide.

2. Seedlings produced on the floating tray system were equally developed and of equal quality. The acceptance, growing and development of such plants in the field were better.

3. Tobacco yield obtained of seedlings from floating tray system was higher and quality was better compared with the tobacco obtained from seedlings grown on plots treated with methyl bromide in the second year of investigation.

4. The cost of one seedling produced in the floating tray system is slightly higher compared to the usual production on plots treated with methyl bromide.

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POSTEPENO UKI NUVAWE NA METI LBROMI DOT VO PROI ZVODSTVOTO NA TUTUNSKI RASAD VO HRVATSKA

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²*I nst i t ut za za{ t i t a na rast eni jat a vo zemjodel st vot o i
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Proi zvodstvoto na tutunski rasad redovno vkl u~uva i pri mena na meti l bromi d za dezi nf ekcija na po~vata. Spored Montreal ski ot protokol , meti l bromi dot e na spi sokot na supstanci i { to ja o{ tetuvaat ozonskata obvi vka. Donesena e odl uka da se zabrani negovata apl i kacija, i toa do 2005 godi na za razvi eni te zemji i do 2015 za zemji te vo razvoj. Proi zvodi tel i te na tutunski rasad od Hrvatska upotrebuvaat okol u 30 toni meti l bromi d godi { no. Ovi e i ndi vi dual ni proi zvodi tel i go organi zi raat svoeto proi zvodstvo preku Hrvatski tutun, "Duhan"-Sl ati na i I nsti tutot za tutun. So cel da se prou~at al ternati vni metodi za meti l bromi dot, razvi ena e dvegodi { na metodol ogi ja so pomo{ na UNIDO i negovi te stru~waci . Pokraj kontrol ni te tret i rawa (Ø i meti l bromi d), vo ovi e i stra` uvawa bea vkl u~eni i pri menata na Dazomet, bi of umi gaci ja i kontejnerski si stem za odgl eduvawe na tutun.

Po dvegodi { ni te i stra` uvawa, so si stemot na kontejneri e dobi en pokval i teten rasad otkol ku so drugi te metodi . Za ovoj metod e potrebno 2-3 pati pomal ku prostor, rasadot e uedna~en, i ma podobro razvi en korenov si stem i se razvi va mnogu podobro po negovoto rasaduvawe na ni va.

Vakvi ot rasad posti gna povi sok pri nos i podobar kval i tet na suvi te l i stovi , kako i maksimal na za{ t i t a na okol i nata i ozonski ot sloj. Ovoj metod na rasadoproi zvodstvo bara ef i kasna edukaci ja na proi zvodi tel i te i speci jal na oprema. Dazomet (Basamid) uspe{ no gi uni { tuva pl evel i te, no mo` e da bi de f i ti toksi ~en za tutunot, osobeno pri ni ski temperaturi koi redovno se javuvaat vo prolet. Ni pri menata na sol ari zaci ja/bi of umi gaci ja kon krajot na septemvri ne be{ e ef i kasna, i sto taka poradi ni ski te temperaturi i povtorno to pojavuvawe i razvoj na pl evel i te vo tekot na 'rteweto na tutunot.

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