# ABSTRACT

**Key words: horticulture technologies, vegetable growing, floriculture growing, mulch, superabsorbants**

World agriculture has obtained remarkable results during the last century, marked by the famous "green revolution", which aimed to resolve the problem of properly feeding the world population. This objective was mostly achieved, but remained unsolved the problem of food distribution in all world regions.

Important, technically, is that the success of green revolution was achieved by practicing intensive agriculture based on chemicalization, irrigation, mechanization and use of modern varieties. Sometimes the factors for an intensive agriculture were not used rationally and, consequently, the agricultural ecosystem has been seriously degraded and polluted. In this case, the major problems of agriculture in the last century seem to continue, it is true, in other forms in the 21st century too. Therefore, agricultural science and technology are the subject to new challenges. Thus, the need for modernization and improvement of cultivation technologies is always present (**Munteanu** and **Rominger**, 2001).

In the recent decades, vegetable growing, a special field of horticulture, has come a fascinating path identification and promotion of techniques and technologies to promote sustainable agricultural production.

Sustainable agriculture consists in raising the productivity, obtaining reliable and consistent profits with minimal negative environmental impacts and ensuring food security of the population (**Fordham** and **Biggs**, 1985; **Davidescu** şi **Davidescu**, 1992; **Ciofu** şi colab., 2003).

In Romania, under these conditions, vegetable production modernization should meet the requirements of organic/ecological farming and sustainability of the cultivation environment/ecosystem.

As a response to these requirements and in step with the advanced technologies applied in the agriculture of other countries, we have proposed through the thesis research

theme the introduction of non-conventional means to improve the quality and dynamics of vegetation factors for vegetable and floriculture crops.

The materials which were taken to study for thesis research were as following: *superabsorbents* and *nonwoven textiles* and, as techniques, *the mulching of vegetable and floriculture crops* and *preparation of nutrient mixtures* for vegetable and flower seedlings by using superabsorbents.

Mulching is a technique through which the surface between cultivated plants is covered with a thin layer of different materials, a process which clearly shows a number of features highlighted by over time through experience and practice: preventing the crust and weeds emergence, keeping moisture in the soil and allowing faster soil warming, improving air system and soil porosity, keeping clean the edible parts in contact with soil, favorably influencing production, precocity and quality.

The mulching materials used in vegetable and floriculture crops or other horticulture crops are divided into two main categories: *organic materials* (straw, hay, leaves, bark, sawdust, compost, newspaper, peat, pine needles, chips of wood, corn stalks, achenes of buckwheat, peanut shells, stems of tobacco plants, evergreen trees leaves, polyethylene, etc.) and *inorganic materials* (gravel, crushed stone, sand, volcanic ash, etc.).

Very promising elements are some mulch systems or techniques in which are used composite products or materials unusable for mulching. In some such techniques are used combined methods.

Superabsorbents are organic polymers that can absorb large quantities of liquids from 100 to 500 - 600 times their weight and not easily release (by pressure) the accumulated fluid.

To achieve the proposed objective, research work was properly structured in three series of objectives:

- objectives regarding landscape, organizational and institutional conditions;
- objectives regarding the mulching influence on some vegetable and floriculture crops;
- objectives regarding the influence of superabsorbents application on vegetable crops;

The purpose and objectives have been achieved by three sets of studies and research corresponding to the three sets of objectives:

a) The study of landscape, organizational and institutional conditions in which research have been organized;
b) Research regarding mulching influence on some vegetable crops;

c) Research regarding superabsorbents influence on vegetable and floriculture crops.

During research two categories of material have been used: **organic material** - pepper (*Capsicum annuum* L.), eggplants (*Solanum melongena* L.) white cabbage (*Brassica oleracea* L. var. capitata L., f . alba DC.), tomatoes (*Lycopersicon esculentum* Mill), cucumber (*Cucumis sativus* L.), french marigolds (*Tagetes patula* L.), China aster (*Callistephus chinensis* Ness) and double – flowers stocks (*Matthiola incana* Br.) and **technical material** (the mulch material and superabsorbents).

The general research methods were **observation** and **experiment**.

In the framework of the study and in order to achieve the objectives, the following experiments were organized:

The **experience $e_1$** ("The assessment of unwoven textiles mulching quality on some vegetable crops in the field"). In this bi – factorial experience two experimental factors were studied:

- factor A - vegetable crop with four graduations/four species: $a_1$ = green pepper, $a_2$ = eggplants, $a_3$ = autumn cabbage, $a_4$ = autumn cauliflower;
- factor B – unwoven textile with four graduations: $b_1$ = no mulching, $b_2$ = mulching with TN – 1 unwoven textile, $b_3$ = mulching with TN – 2 unwoven textile, $b_4$ = mulching with TN – 3 unwoven textile.

In the **experience $e_2$** ("The assessment of mulching quality on some vegetable crops in solar) were also studied two experimental factors (A and B), but with different graduations:

- factor A (vegetable crop) had two graduations: $a_1$ = tomato crop and $a_2$ = cucumber crop;
- factor B (unwoven textile) had four graduations: $b_1$ = no unwoven textile, $b_2$ = mulching with TN – 1 unwoven textile, $b_3$ = mulching with TN – 2 unwoven textile, $b_4$ = mulching with TN – 3 unwoven textile.

**Experience $e_3$** ("The study of the mulching materials influence on vegetable crops in solar") was achieved in 2007 and 2008, using preliminary results from experience $e_2$ (choosing the best option for unwoven textiles used as mulch). The experience was a bi – factorial one:

- factor A and its graduations are identical to those used in the previous experience ($a_2$): $a_1$ = tomato crop (cultivar Marissa $F_1$) and $a_2$ = cucumber crop (cultivar Triumf $F_1$);

- factor B – mulch type with four graduations: $b_1$ = no mulching, $b_2$ = unwoven textile TN - 2, $b_3$ = biodegradable polyethylene film, $b_4$ = wheat straw.

**Experience $e_4$** ("The study of some mulching materials influence on floriculture crops"). The experience was achieved in three experimental years (2006, 2007 and 2008). In this bi - factorial experience the following factors were studied: floriculture crop and mulching material:

- factor A - floriculture crop - had three graduations: $a_1$ – China aster (cultivar Duchesse varie), $a_2$ – double – flowered stocks (cultivar Excelsior) and marigolds (cultivar Anda);
- factor B - mulching material type – in the following graduations: $b_1$ = no mulching, $b_2$ = TN – 2 unwoven textile, $b_3$ = black biodegradable polyethylene film and $b_4$ = wood chips.

The conclusions emerged from the research were as following:

1. **Regarding the assessment of the unwoven textiles mulching quality under field conditions**:

- The soil humidity study emphasized that the unwoven textiles provide a better moisture regime through a high humidity level and a constant soil moisture status. Also, it has been demonstrated the unwoven textiles ability to conserve moisture.

- The study on weeds has demonstrated the unwoven textiles mulching quality. The number of weeds per unit area ($m^2$) was significantly lower for mulched variants. Another important observation is that a dominance of monocots weeds makes less effective the mulching with unwoven textiles. These materials as well as others do not block totally the weeds access to the soil surface.

- The production results analysis showed that the variants mulched with unwoven textiles (TN - 1 and TN - 2) from unmulched variants. The largest production increases were registered in the green pepper crop.

2. **Regarding the assessment of the unwoven textiles mulching quality under solar conditions**:

- The study of soil humidity in the conditions of a solar experience showed that the mulching with unwoven textiles had no obvious differences on soil moisture regime.

- The study on weeds emphasized the unwoven textiles mulching quality under solar conditions too, but in a less obvious way than in field crops. This was due to a lower degree of "weeds attack" in the cultivated land.

- The production results analysis revealed the efficiency of using unwoven textiles for mulching vegetables under solar conditions. In fact, it is known that production results are an indirect assessment criterion based on the direct effect on soil quality and crop microclimate. Production results analyzed have proved the unwoven textile mulching superiority towards the crop maintenance by weeding crops (no mulch application).

3. **The influence of some mulching materials (foil, straw, unwoven textiles) applied on organic vegetable crops under solar conditions**:

- The study on soil humidity due to different types of mulch applied on tomato and cucumbers under solar conditions revealed that the materials used as mulch had a positive influence on soil water regime through better water conservation and reducing the water variation amplitude over time. At the same time it should be noted that polyethylene film will provide better conservation of soil water compared with unwoven textiles and straw. From this perspective the film is superior, but practical observations of the experiment showed that this material does not allow watering by sprinklers, only small amounts for humidifying the growing area.

- The study regarding the „weeds attack" demonstrated the usefulness of mulching and highlighted the different effectiveness of used materials. Therefore, the mulching is a work that can be used in upgrading technologies for growing vegetables.

- The production results analysis can be (also in this case) the main criterion for assessing the positive effect of mulching and also of some experimental mulch materials. It must be noted that mulching was a factor for increasing yields of both crops. We also noted from the beginning that production levels (for those two crops) are mostly similar to that of previous experience (with unwoven textiles). In terms of production, the most effective was the straw mulch, followed by unwoven textiles. Foil mulching, modern and very easy to achieve in practice came in last place among the materials used, although with differences in production of over 11% and provided 99% statistical probability. Probably, the eficiency for such material might be superior to other alternatives (due to lower costs), but this kind of studies were not possible in the organizational framework of the research. In fact, the results are mostly confirmed by other studies and practical observations, as shown in Chapter II.

4. **The influence of some mulch materials on floriculture crops under field conditions**

- Soil moisture study revealed that mulch materials – polyethylene film, TN – 2 unwoven textile, wood chips – have qualities of changing in a positive way the water regime in flower field crops. The data presented show that, in all crops, the unmulched variants had a

lower level of humidity and relatively large variations between the values measured at four moments.

- The study of weed growth in floriculture crops reveal that (even in these crops) mulching can be an effective means of weed control. In terms of testing the three mulch materials, some differences emerge, but generally, all the materials studied have a good effect against weeds.

Seedling production is one of the most important technological links which is the forerunner of establishing vegetable crops.

Consistent to the general idea of modernization (improvement) of the complex technology of vegetable production by using materials that can help the modernization, we decided to stop on the *superabsorbents* use for seedlings production.

Research goal in this chapter is *to improve the quality substrates for the production of seedlings using superabsorbents*.

To achieve this goal the following objectives were proposed:

- the study of chosen substrates influence on seed germination and plants emergence;
- determining the seedlings quality according to the substrates used;
- the study on the influence of seedlings (produced on different substrates) on production.

In addition to this, research will highlight the differences between the substrates used (with and without superabsorbents) on three vegetable crops: tomatoes, peppers and early cucumbers.

Research will allow the knowledge of aspects regarding the germination/emergence, and the assessment of seedlings quality.

Experimental investigations were conducted (on a series of experiments according to the targets) in the experimental field of Department of Vegetable Growing, Faculty of Horticulture from UASVM Iassy, in the Didactic Station "Vasile Adamachi" during 2006 - 2008.

To achieve these objectives the following experiences were organized:

- $e_1$ - Study of superabsorbents substrates influence on tomato seedlings;
- $e_2$ - Study of superabsorbents substrates influence on green pepper seedlings;
- $e_3$ - Study of superabsorbents substrates influence on cucumber seedlings;
- $e_4$ - Evaluation of tomato production in a crop established with seedlings produced on superabsorbents substrates;

- $e_5$ - Evaluation of green pepper production in a crop established with seedlings produced on superabsorbents substrates;
- $e_6$ - Evaluation of cucumber production in a crop established with seedlings produced on superabsorbents substrates.

For this series of experiments two types of experimental materials were used: *biological material* (seeds and seedlings) and *technical material* (material used in nutrient substrates and superabsorbants).

Research has emphasized results which demonstrate the objective accomplishment.

5. **The study of superabsorbents substrates influence on tomato seedlings**

Research results obtained from the study showed that substrates used to obtain tomato seedlings were significantly influenced from the quantitative and qualitative perspective. The influence of these substrates was highlighted regarding the main indicators of germination and emergence (emergence dynamics, emergence rate dynamics and velocity emergence dynamics) and seedlings quality.

Analyzing similar variants (the ones with superabsorbents) we noticed that all these variants had a better emergence.

SAB apparent positive effect comes out from water retention capacity and from ability to maintain the water level as constant as possible within the substrate during emergence.

Important to note is that adding the SAB into the nutrient mixture it can be increase the average rate of emergence and more important is that higher rates of early days ensure greater uniformity in age and hence the development of seedlings.

*Emergence velocity and velocity coefficient* were affected favorably by adding superabsorbents into the nutrient substrates used to produce seedlings.

6. Reffering to **superbasorbents substrates influence on green pepper seedlings**

Graphic representations of the green pepper emergence dynamics of mixture with and without superabsorbents highlight the differences between similar variants caused by the presence of superabsorbents into the nutrient mixture.

7. **The yield assessment of tomato crop established with seedlings produced on substrates with superabsorbents**

The data presented show that the early yield had largely varied with values between 12,6 t/ha for variant V5 ($T_{75}$ + $N_{25}$) and 24,6 t/ha for variant V8 ($T_{60}$ + $M_{40}$ + SAB); the variant without SAB - V1 ($T_{100}$) registered 17,2 t/ha.

*Total yield* emphasized that the significant differences between variants and witness are less; this fact proves that the differences between variants are decreasing over time.

8. **The yield assessment of green pepper crop established with seedlings produced on substrates with superabsorbents**

As in the tomato crop situation, the SAB effect on early yield, as on total yield in green pepper crop is beneficial by increasing the production, but not in a very significant way; in other words, the beneficial SAB effect is unsignificant for the yield.

Important yield increases were achieved by the variants with SAB.

9. **The yield assessment of cucumber crop established with seedlings produced on substrates with superabsorbents**

Even in this experiment, the SAB variants had registered superior yields than the variants without SAB; the differences between V2 ($T_{100}$ + SAB) – 22,1 t/ha and V1 ($T_{100}$) – 18,5 t/ha are significant.

It also can be observed that the smallest production results were obtained for the variants with a peat and sand based substrate – 16,5 t/ha (V5) și 17,9 t/ha (V6).