

## RESEARCHES ON TILLERS APPEARANCE ON ACTUAL CORN HYBRIDS (ZEA MAYS L.), IN THE EASTERN PART OF ROMANIA

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### Abstract

Farmers frequently face abnormalities in corn when the crop experienced a major stress. Severe climatic conditions (for instance, hail, frost or flood), which destroy or affect the plant's growth top, can lead to tillers appearance and unproductive plants.

The tillers are actually branches that are developed from axillary buds from the bottom of plant stem. The tillers are similar in morphology, with the main stem and are able to form their own root system, nodes, internodes, leaves, female and male flowers.

The purpose of this study is to determine the incidence of corn tillers on actual hybrids in the eastern part of Romania and to identify the major stress factors that have led them.

The research methodology involved observations in vegetation, such as: climatic factors, applied technology, major stress factors (drought, extreme temperatures, damage caused by chemicals applied wrong), etc.

The tillers appearance in the studied locations was facilitated by the following causes: post-emergence spring cold, the stress of herbicides application after 6-8 leaf stage, inadequate density, well supplied soil in nutrients etc.

**Key words:** actual hybrids, corn, tillers, stress

With the intensification of farming, new problems arise, such as abnormalities in hybrids of corn, which can sometimes lead to large losses of yield.

Farmers frequently face abnormalities of corn when the crop experienced a **major stress** such as drought, extreme temperatures, disease and injury caused by insects, or misapplied chemicals.

**Severe climatic conditions** (eg. hail, frost or flood), which destroy or affect the plant's top growth can lead to tillers and unproductive plants.

The emergence of tillers is a normal physiological response of corn.

**Tillers** are actually branches that are developed from axillary buds in the bottom of the plant stem. Tillers are similar in morphology, with the main stem and are able to form their own root system, nodes, internodes and leaves, female and male flowers (fig. 1).

Most agronomists agree that **tillers** appearance is a signal showing that the corn growing conditions are very favorable, with ample levels of nutrients, water and light.

Tillers can compete to some extent with the main stem, but given their appearance relatively late, usually lose in the competition for nutrients, water and light.

One or more tillers usually occur if the main stem is injured or destroyed by hail, frost, insects,

wind, tractor wheels, active organs of machines etc., in the first half of the season (fig. 2).

If damage occurs early enough during the growing season, the tillers can produce harvested cobs.

Tillers that appear later usually don't have enough time to develop cobs, to reach maturity before being destroyed by an autumn frost.

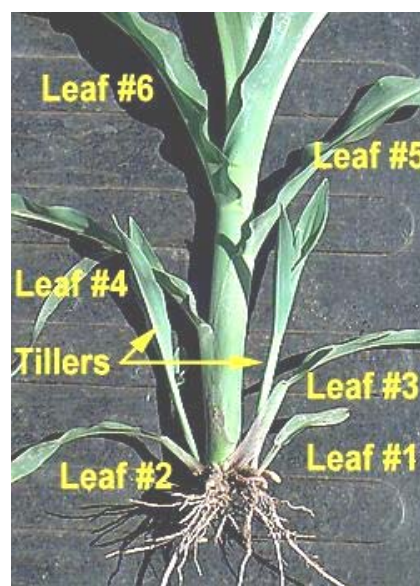


Figure 1 Tillers in corn  
(Source: Nielsen R.L. Bob, 2003)

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Recent studies have shown that **the transfer of sugars from the main plant and tillers is very low before the tassel appearance** (Nielsen RL (Bob), 2003). However, after and during the formation of kernels substantial amounts of sugars can be transferred from the tillers without cobs to the main plant. When there are cobs both on main plant and on the tiller, the transfer of sugars is very low.

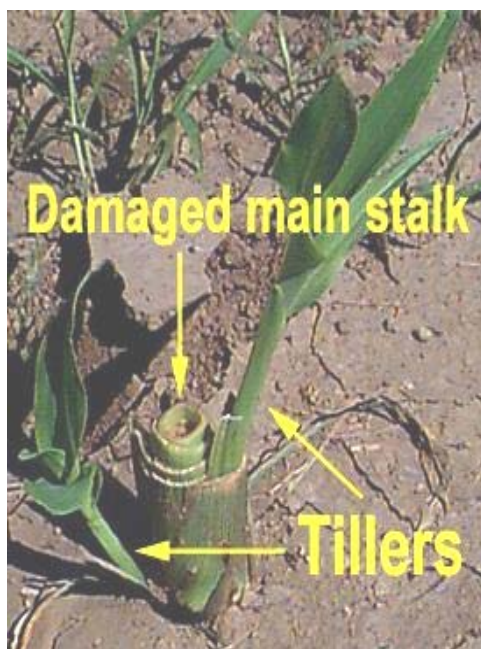


Figure 2 Tillers in corn as response to main stem injury (Source: Nielsen R.L. (Bob), 2003)

The main plant and tillers act independently, each receiving sugar from their leaves. Thus, the underdeveloped cobs, which can occur in tillers, have no impact on main plant cob development, as once thought.

**Excessive appearance of tillers may indicate density or distribution problems.** If the tillers occurrence is associated with gaps in rows or plant density, less than optimal, these problems should be corrected to ensure optimal yield and not hybrid selection.

Tillers appearance may be caused by diseases such as "crazy top" and "bacterial wilt" (which are associated with other symptoms) (Thomison PR, 2011).

**Crazy top** rarely causes losses in corn. The disease occurs where soils were saturated with water 24 to 48 hours after sowing.

Most characteristic symptom is the proliferation of structures such as leaves in a tassel and / or cob, hence the name: "Crazy top". In many cases occur only leafy protrusions in cobs, especially in the insertion. Affected plants may have an exaggerated appearance of tillers.

Crazy top is caused by a fungus in the soil, *Sclerospora graminicola* (*Sclerophthora*

*macrospora*) (Iacob Viorica, 2004, Lipps PE, Mills DR, 2011) (fig. 3).

#### **Bacterial wilt and leaf blight of corn**

The greatest damage occurs in the season upcoming a mild winters. Temperatures from mild winters favor insect survival over winter, which are vectors for pathogenic bacteria transmission.



Figure 3 Crazy top in corn (Downy mildew) (Source: Nielsen, R.L. (Bob), 2009)

Young plants become infected, usually wither and die.

Young affected plants usually develop yellow to white stripes on the lower leaves. **These plants produce, usually, more tillers.** Plants that don't die, stop from growth and typically do not produce cobs.

Leaf blight can be recognized as the leaves appear in the form of long pale green stripes. As the stripes are larger, large portions are yellow and then brown. Streaks can occur along the entire length of the leaf and their edges curl. Some characteristic lesions can be seen early in the season, but many lesions can not usually be detected until after the formation of tassel. Plant susceptibility increases after the formation of tassel, probably a physiological response in the plant reproductive phase (Lipps P. E., Dorrance Anne E., Mills D. R., 2011).

The disease is caused by the bacterium *Pantoea stewartii* (*Erwinia stewartii* (Smith) Dye, *Xanthomonas stewartii* (Smith) Dowson), which enters the plant through wounds caused by insect vector, such as flea ground (*Chaetocnema pulicaria*) (fig. 4).



Figure 4 Bacterial wilt and leaf blight of corn (elongated lesions with ruffled edges) (Source: Lipps P.E., Dorrance Anne E., Mills D.R., 2011)

### MATERIAL AND METHOD

The research methodology involves observations in vegetation in six locations to determine current incidence of tillers in corn hybrids in the eastern part of Romania, in 2011, targeting in particular the counties: Neamt, Iasi, Vaslui and Bacau.

The observations were taken into account: climatic factors, applied technology, major stressors such as drought, extreme temperatures, damage caused by chemicals applied incorrectly etc.

### RESULTS AND DISCUSSIONS

#### Climatic factors

In all locations, during the sowing time, were registered low temperatures and large amounts of precipitation, which favored the emergence of the tillers. For instance, at Weather station Iasi, from 8 to 18 April 2011, there were very small minimum daily temperatures of 2-4 °C and large amounts of rainfall, of 62.6 mm (fig. 5).

#### Applied technology

The emergence of tillers in the analyzed location was favored by the following causes: stress of applying herbicides after 8 leaf stage, inadequate density, soil well supplied in nutrients (tab. 1, fig. 6).

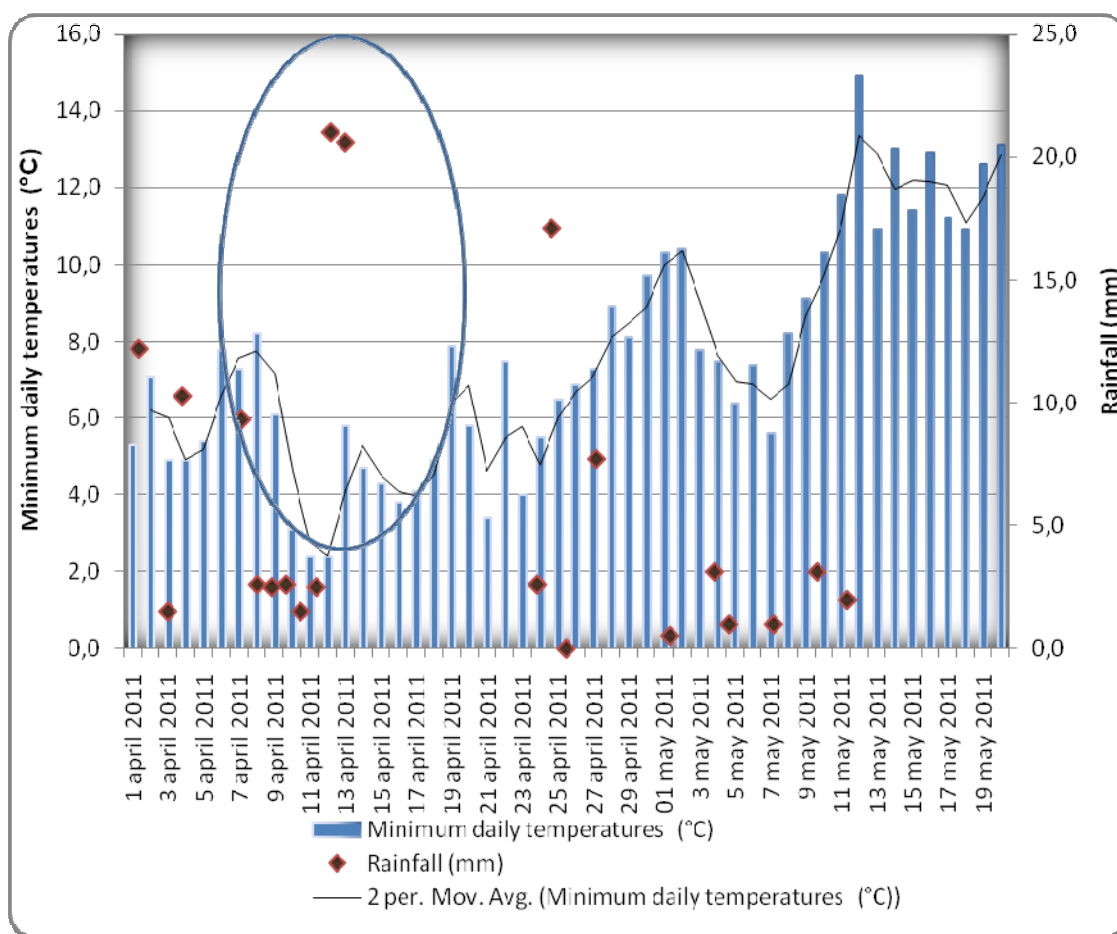


Figure 5 Climate data registered at Weather Station Iasi (April - May 2011)

Table1

**Technological factors that have favored the emergence of tillers**

No.	Location	Technological factors	Time of tillers emergence
1	Horia locality, Neamț County	Soils well supplied in nutrients and water. No technical errors were identified.	4-leaf stage
2	Andrieșeni locality, Iași County	Applying postemergent herbicides in an advanced stage of corn growth (after 8 leaves)	After 8 leaves
3	Căbești locality, Bacău County	Applying postemergent herbicides in an advanced stage of corn growth (after 8 leaves)	After 8 leaves
4	Letea Veche locality, Bacău County	Applying postemergent herbicides in an advanced stage of corn growth (after 8 leaves) on a well stocked agrofond in nutrients and water.	After 6 leaves
5	Crețești locality, Vaslui County (1)	Low seeding density (about 50,000 plants / ha), soil well stocked in nutrients and water, until the tassel appearance.	4-leaf stage
6	Crețești locality, Vaslui County (2)	Applying an improper dose (increased) of herbicide postemergent combined with a low seeding density (about 50,000 plants / ha), a well stocked agrofond in nutrients and water, until the tassel appearance.	4-leaf stage



Figure 6 Tillers in corn (Crețești locality, Vaslui County)

Throughout the study, observations were made on the evolution of the tillers, after their formation. Thus it was observed that in locations where there were large amounts of precipitation and the water and nutrients supply was high, the tillers evolved and form mainly tassel ears. For example, in Horia locality, 60% of tillers, formed male and female flowers on top of the stem, 20% formed only male flowers on top of the stem, 10% formed female flowers that have developed almost normal cobs and 10% formed male and female flowers normally positioned, resulting almost normal cobs (fig. 7, fig. 8).



Figure 7 Tassel ears in corn with tillers (ginandromorfism) – Horia locality, Neamț County

**Main stem height** was equal in four locations at the plants with tillers and normal plants, without child. In Horia locality, on average, the main stem size was 5 cm less in plants with tillers than in normal plants without tillers, and in Letea Veche was 3 cm less (fig. 9).

Analyzing the tillers height in relation to the main stem of the plant, there were variations in the followed locations, such as: Horia 60%, Andrieseni, 35%, Cabesti 37%, 46% Letea Veche, Cretesti (1) 33%, Cretesti (2) 30%.

Comparing **the size of cobs** from plants with tillers and plants without tillers, it was observed that the differences are insignificant (fig. 10).

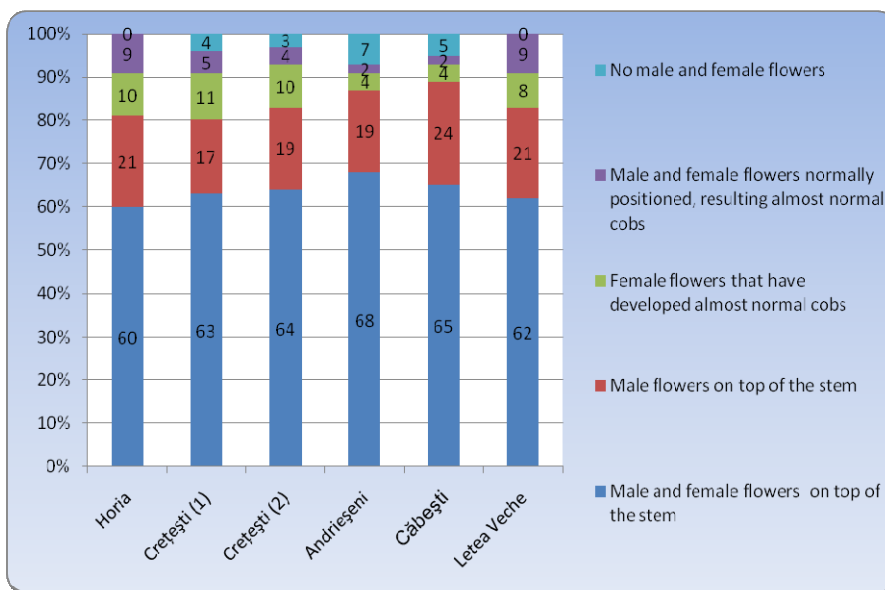


Figure 8 The presence of male and female flowers on tillers



Figure 9 The main stem size in plants with tillers and without tillers (Andrieșeni Locality)



Figure 10 Cobs size in plants with tillers and without tillers (Andrieșeni Locality)

To determine the incidence of tillers were given grades from 1 to 9, after the frequency (0 missing, 1 a few, 9 very much).

Highest frequency of the tillers were registered in locations Crețești, Vaslui County (18.75%) and Letea Veche, Bacău County (17.56%) (tab. 2).

In terms of **average number of tillers per plant**, it was observed that most plants have formed two tillers (fig. 11).

Table 2  
Incidence of tillers appearance in the studied locations

No.	Location	Group of hybrid maturity	Note	-%-
1	Horia locality, Neamț County	Very early	2.52	15.75
2	Andrieșeni locality, Iași County	Early	2.35	14.69
3	Căbești locality, Bacău County	Medium	2.33	14.56
4	Letea Veche locality, Bacău County	Medium	2.81	17.56
5	Crețești locality, Vaslui County (1)	Very early	2.43	15.19
6	Crețești locality, Vaslui County (2)	Early	3.00	18.75

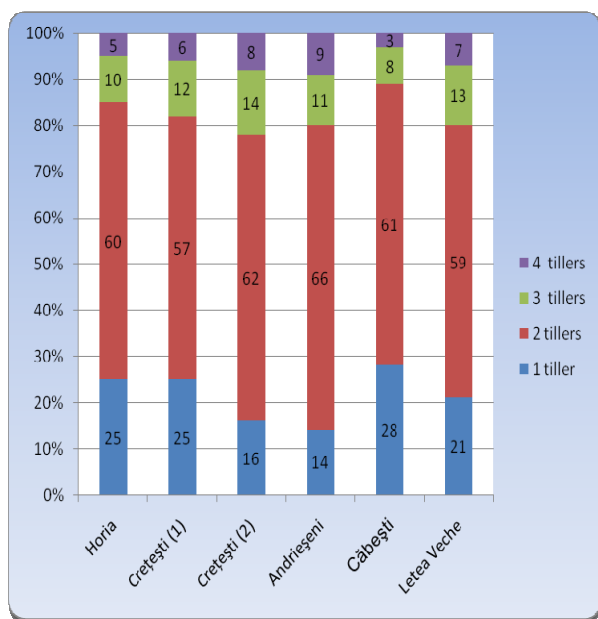


Figure 11 Average number of tillers per plant

## CONCLUSIONS

Tillers are branches that grow from axillary buds in the bottom of the plant stem. The main reasons that cause the tillers, described in the literature are: severe weather conditions that destroy or affect the plant's top growth; conditions very favorable for corn growing, with large levels of nutrients, water and light; injury or destruction of the main stem by hail, frost, insects, wind, tractor wheels, active organs of machines etc, in the first half of the season; gaps in rows or plant density, lower than optimum; some diseases such as "crazy top" and "bacterial wilt" (which are associated with other symptoms).

In the analyzed locations in eastern part of Romania, at the current corn hybrids, were identified the following factors which have led the tillers appearance: cold spring from post-emergence time; stress caused by the application of herbicides after the 8 leaf stage; inadequate density; good soil supplied in nutrients and water.

Throughout the study, observations were made on the evolution of tillers, after their formation. Thus it was observed that, in locations where there were large amounts of rainfall and the water and nutrients supply was high, tillers evolved mainly in tassel ear, and also cobs with normal position, with almost normal development.

The highest frequency of tillers was in Crețești locations, Vaslui County (18.75%) and Letea Veche, Bacau County (17.56%).

Tillers height ranged from 30-60%, of the main plant stem, being higher in areas with better nutrient and water supplies.

In terms of plant height with tillers against plants with no tillers, no significant differences were noted.

Cob size formed by plants with tillers showed no differences compared with cob size formed by plants without tillers.

Following observation made in the six locations, sustain the idea, that the appearance of tillers in corn plants, has no negative impact on obtained yield.

## ACKNOWLEDGEMENTS

„This work was cofinanced from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/I.89 /I.5/S62371 „Postdoctoral Schole in Agriculture and Veterinary Medicine area”.

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