Influence of transplanter modifications and cover crop mulches on the production of summer vegetables in conservation tillage

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AIM: To develop a vegetable transplanter that is capable of working in no-tillage conditions and in presence of organic mulches which cover the soil

REQUIREMENTS FOR A SUCCESSFUL NO-TILL TRANSPLANTER

The requirements for developing a successful transplanter in no-tillage conditions are:

- An adequate structure and implements that can transplant under the most challenging conditions;
- The possibility of placing vegetable seedlings in areas with high amounts of residues without disturbing the soil more than necessary;
- The creation of a furrow for proper seedling placement;
- Being able to cover the vegetable root system with soil in presence of a superficial mulch layer.

Fig. 1. No-till transplanter unit.

TRANSPLANTER MODIFICATION DESCRIPTION

A Ferrari FMAX transplanter was modified in order to transplant vegetable seedlings in no-tilled soil covered by organic mulches. A typical vegetable transplanter is usually composed of a furrow-opening shoe, a carousel mechanism and a contact drive system. The new transplanter developed for no-till use required the addition of implements for creating furrows in untilled soil, arranging the plantlets, and covering the roots while leaving the soil relatively undisturbed (Fig. 1).

The front disc (Fig. 2) slices the organic mulch, thus loosening the soil without inverting or incorporating the residues. The double-disc openers cut the soil, in the trench created by the front disc, in order to facilitate the formation of the furrow and create a suitable environment for seedling placement (Fig. 3). A carousel mechanism was maintained for seedling placement (Fig. 4). The original closing wheels, generally used for directing and compacting the soil in conventional tillage systems were adapted since it was necessary to increase down pressure in order to close the slits created in the organic mulch and in the soil by the discs (Fig. 5).

Figure 2. The front disc used for slicing organic mulch in no-tillage conditions.

Figure 3. Double-disc openers for the furrow formation.

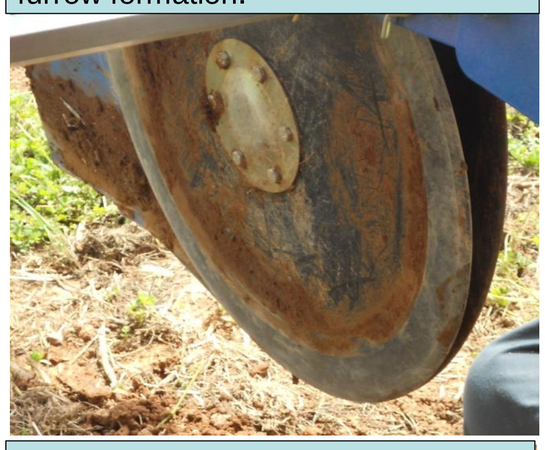
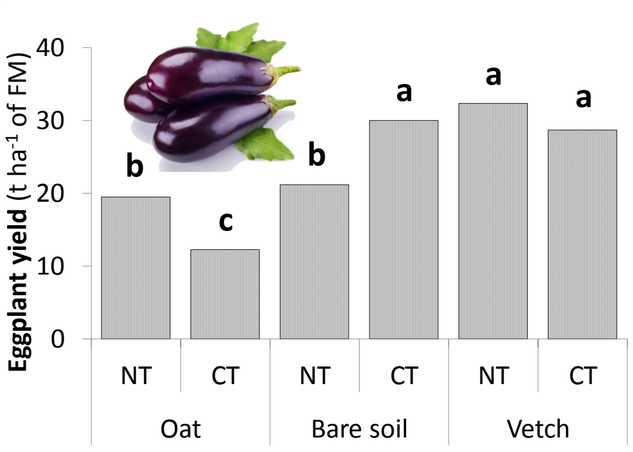


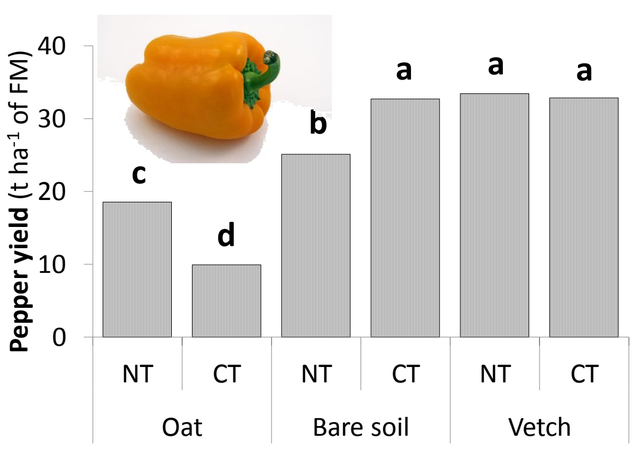
Figure 4. Carousel mechanisms.

Figure 5. Tomato transplated into a hairy vetch mulch.

PRELIMINARY RESULTS ON TOMATO, EGGPLANT AND PEPPER

In the 2014 growing season, field evaluation was carried out at the experimental farm of Tuscia University. Hairy vetch and black oat were selected as organic mulches for testing the performance of the new transplanter on eggplant, pepper and tomato crops. A bare soil was also included. No significant problems were detected during the transplanting operations and in the initial vegetable plant density, even if the hairy vetch mulch proved to be more suitable than the oat mulch. At harvesting, the highest yields were always observed for the vegetables grown on hairy vetch regardless tillage treatments. In oat the no-till treatment showed higher yield values than tilled soil, while an opposite trend was observed in conventional. In conclusion, the results obtained with new no-till transplanter were satisfactory in terms of seedling placement both in no-tilled soil covered by a mulch layer and in conventional tilled soil.





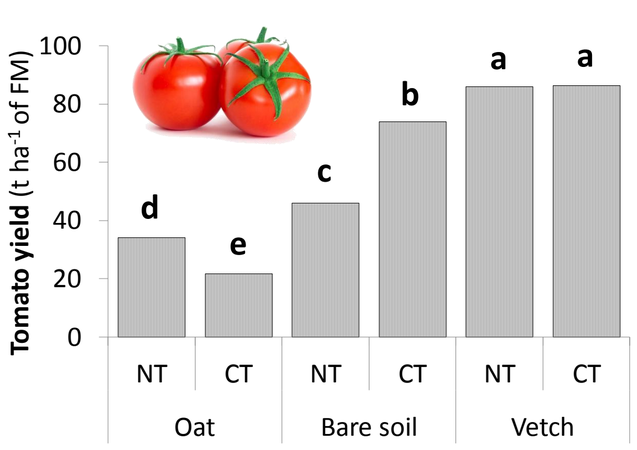


Figure 6. The interaction effect of cover crop x residue management on marketable yield of eggplant, pepper, and tomato. Values belonging to the same character without common letters are statistically different according to LSD (0.05).

NT = No-tillage;
CT = Conventional tillage.