



COMBINING ROLLER CRIMPERS AND FLAMING FOR THE TERMINATION OF COVER CROPS

Cover crops are used in conservation systems to protect the soil from erosion and to prevent weed emergence, thus reducing reliance on herbicides. A cover crop is terminated prior to planting a cash crop, with residues remaining on the soil surface where they act as a dead mulch that suppresses weeds; these residues also protect the soil from rapid desiccation and keep soil moisture at good levels for cash-crop germination and establishment. An effective method to terminate cover crops without herbicides in no-till systems is to use roller crimpers, which may be combined with flaming.

DID YOU KNOW?

Roller crimpers can be used to terminate cover crops without herbicides. Flaming could be an additional tool to improve the effect of rollers and speed up cover-crop termination.

There is a higher termination rate when roller crimpers are used from the flowering stage of legume cover crops and the anthesis of grass cover crops. A delayed termination date for winter-grown cover crops may result in postponed sowing dates for the spring cash crop, likely resulting in yield loss. Thus, it is important to improve the effectiveness of roller crimpers, even at the earlier phenological stages of cover crops; furthermore, roller weight should be increased, blade shape should be adjusted, or crimping combined with flaming. Flaming devitalizes cover-crop plants without tilling the soil, instead using direct heat in the form of fire. The high temperature of the flame denaturizes plant proteins, without burning plant tissues, desiccating them. In a project at the Universities of Pisa and Perugia (see reference below) the best results, i.e. a 90% termination rate after 6 weeks, were achieved with roller crimpers combined with flaming immediately after rolling.

EXPECTED BENEFITS

The combination of roller crimpers and flaming is expected to:

- enhance the effect of lighter roller crimpers used alone;
- allow for early and timely sowing of cash crops following cover-crop termination;
- reduce the need for herbicides.

CRITICAL POINTS/FURTHER RESEARCH NEEDS

Further studies would be needed to enhance the effectiveness of roller crimpers, e.g. by increasing crimper weight and improving blade design. It is also worth investigating the effect of flaming in combination with a range of roller crimpers on other cover crops at various growth stages and in various pedo-climatic conditions. However, the main constraint for a wider adoption of this practice is

still the high cost for farmers. A new prototype of a combined machine, which could simultaneously conduct rolling and flaming, would likely reduce operation costs and boost the large-scale adoption of this crop-management system.



Figure 1 - The Rodale Institute design-based roller crimper front-mounted at the tractor.



Figure 2 - A flaming machine terminating cover crops after the roller crimper has been used.

REFERENCES

Frasconi C, Martelloni L, Antichi D, Raffaelli M, Fontanelli M, Peruzzi A, et al. (2019). Combining roller crimpers and flaming for the termination of cover crops in herbicide-free no-till cropping systems. *PLoS ONE* 14(2): e0211573. <https://doi.org/10.1371/journal.pone.0211573>

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