doi:http://dx.doi.org/10.15414/afz.2015.18.si.10-12

Production capabilities of catch crops

Martina Handlířová *, Blanka Procházková, Vladimír Smutný

Mendel University in Brno, Faculty of Agronomy, Brno, Czech Republic

Within the period of 2011–2014, production capabilities of catch crops were evaluated after two dates of their sowing. The field experiment was established on the field experimental station in Žabčice (South Moravia, Czech Republic). The station is situated in a maize-growing region that is one of the warmest and the driest regions in the Czech Republic. The experiment was performed with the following six species of catch crops: *Sinapis alba, Raphanus sativus v. oleifera, Phacelia tanacetifolia, Secale cereale v. multicaule, Malva verticillata* and *Phalaris canariensis.* Catch crops were sown in August and in September, after the harvest of winter wheat. The growth of catch crops was affected by weather conditions. Higher yields were obtained in variants with the first date of sowing. It was concluded that August was the optimum date of their sowing. In this case the plants could maximally manifest their production potential. This concerned above all plants of *Phacelia tanacetifolia and* those belonging to the family *Brassicaceae.*

Keywords: catch crops, sowing date, yields, weather conditions

1 Introduction

Regarding the current methods of farming (i.e. simpler crop rotations, lack of fertilizing crops and of organic manure), the growing of catch crops is more and more frequent. However, this method of farming may be a challenge. Generally, stands of catch crops are established in periods between growing of two main crops. There are many reasons for the involvement of catch crops into the crop rotation. Catch crops are valuated above all due to the fact that they supply organic matter into the soil, reduce the risk of erosion and constrain the leaching of nitrates (Rinnofner et al., 2008). They also suppress weed infestation (Poggio, 2005) and spreading of diseases (Caner and Tuncer, 2001) and pests (Murakami et al., 2000). The supply of organic matter into the soil affects the cycling of elements (Clarholm et al., 2015) and supports its biological activity (Bot and Benites, 2005). Organic components of soil affect the aggregation of soil particles and improve its water-holding capacity (Franzluebbers, 2002). From the managerial point of view, decisions concerning the sowing date of catch crops are very important and show the maximum impact on production. For that reason it necessary to do this very carefully and with regard to weather conditions; this enables to maximise the production potential of catch crops (Constantin et al., 2015). Brant et al. (2011) also mentioned that yields of catch crops were dependent on weather conditions. Urbatzka et al. (2012) wrote that yields were higher after the first date of sowing. In dry regions, limited amounts of soil moisture reduce biomass production (Bot and Benites, 2005). It is necessary to choose practices that support the optimal content and quality of organic matter in soil. This is essential for soil fertility and for the maintenance of its sustainable production capacity (Bot and Benites, 2005). The aim of this study was to evaluate the quantity of biomass produced by catch crops after two dates of sowing (i.e. in August and in September).

2 Material and Methods

Within the period of 2006–2014, the field experiment was performed on the field experimental station in Žabčice (South Moravia, Czech Republic) in the maize-growing

* **Correspondence:** Martina Handlířová, Mendel University in Brno, Faculty of Agronomy, Department of Agrosystems and Bioclimatology, Zemedelska 1, 613 00 Brno, Czech Republic. E-mail: xhandli1@node.mendelu.cz

region that is characterized as one of the warmest and driest regions in the country. The soil was classified as a clay-loamy luvisol. Values of the average annual precipitation and temperature are 480 mm and 9.3 °C, respectively). Six experimental species of catch crops were as follows: *Sinapis alba, Raphanus sativus v. oleifera, Phacelia tanacetifolia, Secale cereale v. multicaule, Malva verticillata* and *Phalaris canariensis.* Stands of catch crops were established after the harvest of winter wheat on two different dates (variants) of sowing. Variant I was in August while Variant II was in September. Catch crops remained on experimental fields till the spring of the following year.

3 Results

Production capabilities of catch crops are presented in Tab. 1. The highest average yields of dry matter (2.00 t ha^{-1} in Variant I and 0.96 t ha^{-1} in Variant II) were recorded in 2012. A good distribution of rainfalls in the course of the growing season was recorded in 2012. The lowest yields of dry matter (0.87 t ha^{-1} in Variant I and 0.36 t ha^{-1} Variant II) were recorded in 2011.

In Variant I (sowing in August) yields of dry matter were significantly higher than in Variant II (sowing in September). In Variants I and II, yields of *Sinapis alba* ranged from 1.13 to 3.16 t ha^{-1} and from 0.50 to 1.48 t ha^{-1}, respectively. Yields of *Raphanus sativus* v. *oleifera* ranged from 1.33 to 2.25 t.ha^{-1} in Variant I and from 0.65 to 1.53 t ha^{-1} in Variant II. Yields of *Phacelia tanacetifolia* ranged from 1.22 to 2.80 t ha^{-1} and from 0.33 to 1.55 t ha^{-1} (Variant I and Variant II, respectively). Lower yields were recorded in experiments with *Secale cereale* v. *multicaule* (0.54–1.92 t ha^{-1} and 0.22–0.85 t ha^{-1} in Variants I and II, respectively), Malva verticillata (0.88–2.25 t ha^{-1} and 0.05–0.21 t ha^{-1} in Variants I and II, respectively) and *Phalaris canariensis* (0.14–1.16 t ha^{-1} and 0.00–0.23 t ha^{-1} in Variants I and II, respectively).

Table 1 Yields of dry matter (t ha^{-1})

Yields of dry matter (t ha^{-1})	2011		2012		2013		2014	
	Date of sowing							
	Var. I	Var. II	Var. I	Var. II	Var. I	Var. II	Var. I	Var. II
Sinapis alba	1.13	0.50	2.50	1.48	3.16	0.79	2.04	0.53
Raphanus sativus v. oleifera	1.33	0.65	2.25	1.53	2.09	0.76	1.70	0.77
Phacelia tanacetifolia	1.22	0.47	2.80	1.55	2.49	0.33	1.87	0.35
Secale cereale v. multicaule	0.54	0.33	1.40	0.85	1.92	0.33	1.13	0.22
Malva verticillata	0.88	0.21	2.25	0.16	1.33	0.05	0.81	0.09
Phalaris canariensis	0.14	0.00	0.78	0.23	1.16	0.06	0.61	0.08
Average	0.87	0.36	2.00	0.96	2.03	0.39	1.36	0.34

4 Conclusions

The growth of catch crops was affected by weather conditions existing in a given year. This coincides with data published by Brant et al. (2011) who mentioned that yields of catch crops depended on weather conditions. Higher yields were obtained in Variants I than in Variants II. Urbatzka et al. (2012) reported that higher yields were recorded after the first date of sowing. This means that the role of the first date of sowing was important. From the managerial point of view, decisions concerning the sowing date of catch crops are very important and show the maximum impact on production. For that reason it is necessary to match the date of sowing to weather conditions. Constantin et al. (2015) wrote that in this way it was possible to maximize the production potential of catch crops. *Sinapis alba*, *Phacelia tanacetifolia* and *Raphanus sativus* v. *oleifera* showed regularly the highest yields.

Lower yields were recorded in experiments with *Secale cereale v. multicaule*, *Malva verticillata* and *Phalaris canariensis*. The Žabčice experimental station is situated in one of the warmest and driest regions of the Czech Republic. In dry areas, a limited content of moisture in soil reduces production of biomass (Bot and Benites, 2005). This means that it is necessary to choose practices that support the optimal content and quality of organic matter in soil. This is essential for soil fertility and for the maintenance of its sustainable production capacity (Bot and Benites, 2005). If we want to maximize utilization of the production potential of catch crops, the optimum date of sowing is in August. This concerns above all members of the family *Brassicaceae* and the species *Phacelia tanacetifolia.*

5 Acknowledgements

This article was elaborated within the project IGA AF MENDELU no. IP 18/2015, which has been designed at the Mendel University in Brno.

References

BOT, A., and BENITES, J. (2005) *The importance of soil organic matter: Key to drought-resistant soil and sustained food production*. Rome: FAO.

BRANT, V. et al. (2011) Biomass and energy production of catch crops in areas with deficiency of precipitation during summer period in central Bohemia. In *Biomass and Bioenergy*, vol. 35, no. 3, pp. 1286-1294.

CANER, Y.K. and TUNCER, C. (2001) Effects of intercropping of corn with bean, soybean and squash on the damage of the European corn borer (Ostrinia nubilalis Hbn. Lepidoptera: Pyralidae) and parasitism of egg masses. In *Ondokuz Mayis Universitesi, Ziraat Fakultesi Dergisi*, vol. 16, no. 3, pp. 55-62.

CLARHOLM, M. et al. (2015) Organic acid induced release of nutrients from metal-stabilized soil organic matter–The unbutton model. In *Soil Biology and Biochemistry*, vol. 84, pp. 168-176.

CONSTANTIN, J. et al. (2015) Catch crop emergence success depends on weather and soil seedbed conditions in interaction with sowing date: A simulation study using the SIMPLE emergence model. In *Field Crops Research*, vol. 176, pp. 22-33.

FRANZLUEBBERS, A. J. (2002) Water infiltration and soil structure related to organic matter and its stratification with depth. In *Soil and Tillage Research*, vol. 66, no. 2, pp. 197-205.

MURAKAMI, H. et al. (2000) Effects of growing leafy daikon (*Raphanus sativus*) on populations of *Plasmodiophora brassicae* (clubroot). In *Plant Pathology*, vol. 49, no. 5, pp. 584-589.

POGGIO, S. L. (2005) Structure of weed communities occurring in monoculture and intercropping of field pea and barley. In *Agriculture, ecosystems & environment*, vol. 109, no. 1, pp. 48-58.

RINNOFNER, T. et al. (2008) Effect of catch crops on N dynamics and following crops in organic fading. In *Agronomy for sustainable development*, vol. 28, no. 4, pp. 551-558.

URBATZKA, P. et al. (2012) Influence of different sowing dates of winter pea genotypes on winter hardiness and productivity as either winter catch crop or seed legume. In Europe. *J. Agronomy*, vol. 40, pp. 112-119.

ZHAO, C.J. et al. 2005. Predicting grain protein content of winter wheat using remote sensing data based on nitrogen status and water stress. In *International Journal of Applied Earth Observation and Geoinformation,* vol. 7, no. 1, pp. 1-9.