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Taifun Soy Info

Specialist information for soy producers and processors

Taifun Zentrum für Sojaanbau

Mixed cropping with soybeans

A natural example of mixed cropping

If you look around in a natural environment, you will notice that many different species coexist on the same area.

The "natural" form of habitat occupation is therefore not a monoculture, which has become increasingly popular with increasing technological development, but mixed cropping. A natural meadow (Fig. 1) is a prime example of the coexistence of different species.

In the following Taifun Soy Info, it will first be clarified how mixed cropping is defined, what advantages and disadvantages it offers and what has to be taken into account when preparing mixtures.

In the second part some mixtures with soy are presented and a short outlook on the latest research work on this topic is given.

Mixed cropping in general

"Mixed cropping refers to the simultaneous cultivation of different crops or varieties of a crop species on a field" [DIETZE, 2009]. This simple definition summarizes the difference to a monoculture very well. The mixed crop should not be confused with nurse crop systems. The difference lies in the fact that the aim of a mixed crop is to harvest all mixing partners. (e.g. oat-peas-barley mixture, clover grass etc.). With nurse-crops, however, a crop is sown into the already growing main crop with the aim to establish the nurse crop by the time the main crop is harvested. Until then the nurse crop will only grow slowly in the shade of the main crop (e.g. clover-grass as a nurse crop in winter wheat). As soon as the main crop is harvested, the nurse-crop can fully develop and sometimes be used in the same year.

Mixed crops offer many opportunities, but also some perils. The biggest advantage of having several crops on one area is the lower risk of total crop failure and lower yield fluctuations. If one partner (almost) fails due to unfavourable conditions, one can still be happy about the yield of the other partner. In the case of mixed crops, it can often be observed that the yields of the mixing partners dynamically adapt to the annual conditions. Furthermore, resources such as nutrients, water and light are often better used. Mixed crops are also interesting with regard to weed regulation.

Through denser stands and the better use of the available light, the ground is usually better shaded. Thus, weeds have less space and light and are better suppressed. Also, the supporting effect of mixed crops can often be the decisive advantage compared to monoculture (e.g. peas with grain).

Where there are advantages, there are of course also disadvantages. Probably the biggest disadvantage of mixed crops is that not all crops can be combined at will. It takes a lot of expertise to find the right mixing partners. From a phytopathological point of view, it must further be taken into account that the stands are usually denser and hence the ventilation is worse. This can promote fungal diseases in the stand or slow down the drying process of late threshing crops after wet nights.

The separation of the mixing partners in threshing cultures is more complex than in monocultures. For this reason, farmers should either have their own cleaning facilities or a customer who takes the time to separate the cultures properly. Also, additional costs arise from the separation.

FiBL has produced a very good and detailed summary: https://shop.fibl.org/chde/mwdownloads/download/link/id/700/

Mixed crops with soy

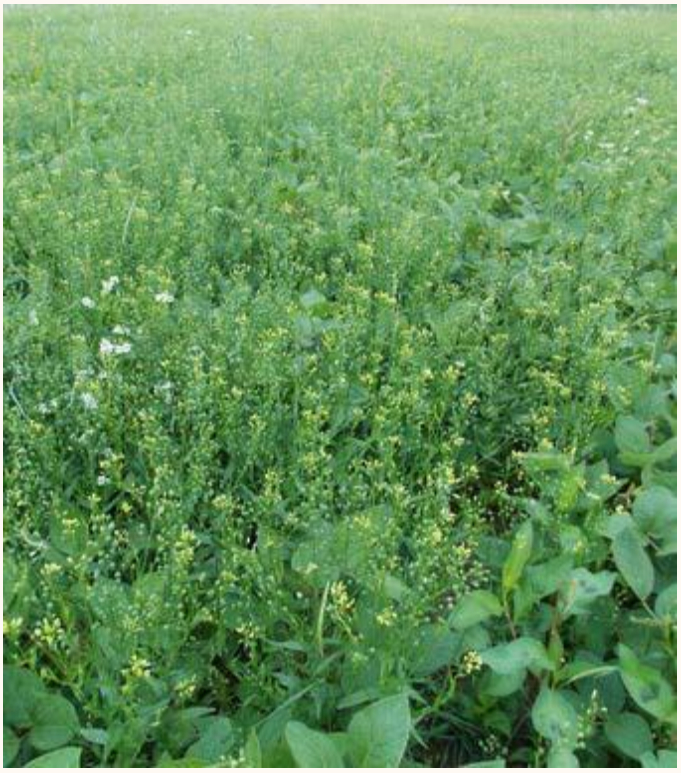
In a trial conducted by FiBL [see Töndury, 2014] at sites in Allen and Vaux-sur-Morges (Romandie), buckwheat of the medium-early variety ‘La Harpe’ was sown simultaneously to the soy sowing. The buckwheat covered the soil very quickly. Due to the very dense stand there were hardly any high-growing weeds (see Fig. 2). Due to the lush growth and rich green colouring of the leaves it was deduced that soy and buckwheat complement each other well as mixing partners. However, the crop was heavily logged at the time of harvest, which made threshing more difficult. Unfortunately, no information on the yield was given by the authors.

From an agronomic point of view, buckwheat should be used with great caution. Although it grows quickly and is a good food source for bees due to its long flowering time, buckwheat also matures very unevenly. This means that the first germinable grains fall out early and remain on the field in the following years as potential weeds. A phenomenon that is also known from early sown catch crop mixtures with buckwheat.

Soy Buckwheat mixture [Source: Töndury, 2014].

Soy / Camelina

At the University of Kassel, experiments on the mixed cultivation of soy with camelina were carried out between 2012 and 2015. Camelina was sown broadcast at three dates (at soy sowing, at field emergence of soy, at the last harrowing of the soy stand). Depending on the weather conditions, the most suitable time for sowing camelina was either shortly before or shortly after soy field emergence. Camelina can already be sown a few days after soy sowing, yet delayed sowing gives the soy stand an advantage which it needs due to its slow youth development. In addition, the first emerging weeds can be reduced by pre-emergence harrowing. The suppressive effect on weeds of camelina lies in the formation of a leaf rosette after gemination. In addition, allelopathic effects, i.e. the secretion of substances that have a growth-inhibiting or -stimulating effect on other plants, are known to occur in camelina [Föller, 2000]. Camelina matures a few weeks before the soybeans. Therefore, it is important to choose a short, late maturing camelina variety. Otherwise the grains can fall out of the relatively burst-resistant pods and the plants will have a strong logging tendency.



Soy-Camelina mixture [Source: Froschhammer]

Camelina and soy complement each other very well in yield. With a strong soy stand, the yield of camelina is at a rather low level of a few decitons per hectare. With a weak soy stand, camelina with a yield of up to 15 decitonnes per hectare provides an attractive profit contribution if it can be marketed for human consumption.

A great challenge in this combination of mixed crops is the threshing. On the one hand, it could be observed on the author's farm that the crop flow, especially in the cutterbar is improved by camelina.

Yet, in order to bring the camelina in the grain tank, the wind setting in the combine thresher must be set as for rape (i.e. little wind), but the sieve and concave settings must be selected in the same way as for soy. The line between too little wind with a resulting heavy strain on the returns and high losses due to too much wind is very narrow and requires an experienced driver. The separation of the threshed crops with a stationary cleaning system is possible without any problems using simple sieving technology.

Soy / winter rye

The FiBL trial (see Töndury, 2014) also tested the combination of soy and spring-sown winter rye. As the spring-sown winter rye does not experience any vernalization stimulus, it does not enter the vegetative phase. The winter rye did not shoot, but merely stagnated and its height was significantly reduced compared to autumn-sown rye.

In this trial, the winter rye was sown in drill rows shortly before the sowing of the soy seeds. The aim was to establish the winter rye in the soy rows. The remaining weed control was carried out with harrow and hoe.

The winter rye established fast with a high density. It also remained low in height. Where winter rye was present in the soy rows, it had an excellent weed suppression effect. Unfortunately, there was also strong competition between winter rye and soy, resulting in a severely reduced growth. Even at the beginning of August, the canopy was not closed, so that weeds were able to accumulate between the soy rows without hindrance.

Since little precipitation fell at the FiBL test site in 2011, the effect of water competition between rye and soy was clearly visible. Since the winter rye does not develop any grains, it cannot provide any financial compensation, as in the case of buckwheat or camelina. Consequently, this combination without irrigation is associated with a high risk. Yet, to date, there is no experience with irrigated sites.

Soy with winter rye. It can be seen that where winter rye is well established, the soybean plants are very small. The poor development in comparison to soybean stand in the background is clearly visible. [Source, Töndury, 2014]

Soy on top

A new approach is to sow soy in existing grain stands (on top). The winter wheat is sown with wide row spacing. Weed regulation is usually done with hoe and harrow. After the last hoeing in spring, the soy seeds are sown between the grain rows.

If everything goes well, the soybean is well established at the time of grain harvest, but still low enough to harvest the grain with a high cutterbar guidance. In autumn the soybean can be harvested from the same area.

There is still little experience with this cultivation system. In particular, topics such as nitrogen fertilization of the grain, which counteracts the nodule formation of soy, are completely unexplored. The advantage of the cultivation system is that the financial aspect is secured by the relatively secure yield of winter wheat and therefore the cultivation risk is relatively low.

This cultivation system, as well as a combination with silage maize, is being researched in the project ‘Soy on top’ by the University of Giessen (2018 – 2021). More detailed information can be found here.

Soybeans in a ripe winter grain crop. The wheat is too short for a clean separated threshing. [Source: Taifun- Tofu GmbH]

Conclusion

Growing mixed crops in combination with soy is still relatively risky at the moment. However, the initial trials conducted by FiBL and the trials of the University of Kassel show that mixed cultivation can work. "Only" the suitable crop combination for the specific location must be found. It can already now be observed, that well-functioning systems at one location may not necessarily function 20 kilometres further away. However, this topic is currently moving more and more into the focus of research. In the course of the next years, both the University of Giessen and FiBL can be expected to produce interesting results.

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www.sojafoerderring.de

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