



Summary PADGG project 2006-2009 (Prevention of Phytophthora by specific tillage times)

The implementation of the intended tillage times were realized in the third and fourth year of the project, and resulted in an improvement of 75% in the field resistance against Phytophthora, compared to the period 2000-2005 preceding the project. This was determined by the cumulative burden of disease during the obligatory burning of crops at the farm of Jan Zenhorst and in 2009 at the farm of Evert Rienks.

This improvement resulted in a prolongation of the growth period of two to four weeks. During the years of the project, the burden of disease was higher than average. In an average situation, the measured cumulative burden of disease would result in a growth prolongation of 6 weeks.

On the untreated (organic) properties the improvement in field resistance resulted in a yield increase of 35% which was in accordance with the expectations that were formulated before the start of the project.

In earlier experimental research only the tuber health was investigated, but the method was already successful then. In the actual project, for the first time also Phytophthora was followed in the crop during several years. The sensitive crop variety Agria was very suitable for this and appeared to give a reaction in the crop from the first year onwards.

A yearly continuation of the implementation of this method during the production of seed-potatoes resulted during the project in a steady improvement of the field resistance. This can be explained from the increasing adaptation of the seed-potatoes to the tillage times. As a result, the effects of the tillage methods are more easily absorbed.

After the method had been applied for three consecutive years, after which the implementation was discontinued, the cumulative positive effects in the crop health relapsed completely. The seed-potatoes were of good quality at that time, but this was no longer activated through the tillage times, as can be concluded.

The yield that was increased over three years, did not relapse (yet) when the implementation of the method was discontinued.

For a long-lasting field resistance it is necessary that the intended tillage times can be implemented easily every year. In addition to the soil type also the early cultivation appeared to play an important role in the implementation. Onions appeared to be an optimal early cultivation for the Agria variety. To grow Agria, after the onion cultivation the soil will be dug over and tilled between September 15 and November 1st, and ploughed between November 1st and 19th. This will be feasible at least on all lighter soil types in the Netherlands. This means that already half of the method will be implemented in the fall.

The use of green manuring meant that the required tillage times could not be realized. This caused a reduced crop health and yield in the following crops of potatoes. The thought that green manure will increase the yield could not be confirmed. Up till now, selective applications of tillage times and their influence on subsequent crops were not taken into account in the regular green manure researches.

The digging under of not yet decomposed plant remains causes the effect of tillage times to come to a halt, as Maria Thun found in her earlier research.

To be able to benefit from the covered soil in fall and winter, it is necessary to implement these more consciously, combined with the required tillage times for the next crops.

Growth cracks in Agria were reduced with two third after having used the tillage time of September 15th to November 1st for 2 years. It is expected that after three years of using this period, the growth cracks will hardly occur anymore.

This tillage time also showed a good field resistance against Phytophthora and the highest yield, therefore it is also recommended to use this period as a variety-specific period for Agria. Initially this period was tested based on the growth characteristics of Agria, this is the common mode of operation for these types of research.

The second recommended variety-specific tillage time for Agria is the Sun-Water period from March 10th till April 19th. This is to support the heavy, large-leaved crop of Agria, the not one-sided long, but reasonably wide tuber growth and the general good reaction of Agria to this period. This is the

same period as the general recommended period for potatoes, March 10th till April 19th, and therefore is this is a twofold recommendation for Agria.

The two variety specific Moon periods for Agria are still to be researched. It is assumed that the Moon-Air period can also be used for Agria due to its flowering, non-berry bearing species. There are two options left for the second Moon period. With additional implementation of the two variety-specific Moon periods an even better crop health can be expected. With a yearly consequent application, a yearly completely maturing of the crop with an optimal yield from 60 tonne or higher can be expected. This can be concluded from the extrapolation of the results.

In the chart you can find a summary of the tillage times that were found to be positive for Agria during the project. The shaded rows represent the periods that are recommended in general for potatoes, these periods did satisfy well for the project. On all investigated farms a decrease in Phytophthora was observed from the first year onwards for these tillage times.

Required tillage times for Agria variety

Level	Sun period	Alternative	Moon period*	Percentage
1	10 Mar – 19 Apr.		Earth	25%
2	1 Nov. – 19 Nov.	15 Febr. – 10 Mar	Fire	25%
3	15 Sept. – 1 Nov.	18 Jan. – 15 Febr.	Air*	25%
4	10 Mar – 19 Apr.		Air*	25%

* One of these periods will be replaced by a Water or Earth period.

During the project, Rhizoctonia disease increased strongly with a unilateral repeating tillage time, even when the correct tillage times were applied. However, scab was increasing with a yearly variety in tillage times. Therefore it is recommended to indicate each year the tillage times for all four levels of the crop. This is to avoid one-sidedness and variety. For our projects with scab and Rhizoctonia disease this gave the best results. Before the start of the project, the principle of consequent implementation for four levels was already indicated, mainly to control the diversity of crop problems. The situation around scab and Rhizoctonia disease confirmed this principle.

With these recent project results, farmers could implement the fourfold tillage times for the Agria variety immediately from the first year onwards, with exception of variety-specific Moon period that has yet to be investigated. It is expected that this will lead to a faster and also more evenly improvement than during the long-term research plan during the last project.

During the project it was not possible to research for Phytophthora in regular crops. But since Phytophthora occurs evenly in normal and organic cultivation, there is no reason to assume that these results will be different on the regular farms. On the two participating regular farms an increase in quality and sorting could be seen, which is an indication of the effectiveness of this method with the use of fertilizer. This was also found in earlier experimental research.

The underwater weight was the highest at the farms with more changes in the tillage times. This was equal to the increase in scab; and can be explained by the stagnation of water absorption by the changed tillage times. The difference on the regular farms was significantly smaller. This is caused by the more adjusted fertilization on the participating farms for seed-potatoes. The more specific fertilizer for potatoes is able to prevent this stagnation better. Therefore, scab and underwater weight would increase to a lesser extent by the changes in tillage times. The usually very early harvesting of seed-potatoes in regular farms can also have played a part in the decrease of these differences.

Bacterial disease did not occur at the organic farm of Jan Zenhorst in the past 19 years, while at this farm only 31% of the cultivation was done at the right tillage times. It is therefore questionable if bacterial disease is connected to tillage times, but it cannot be excluded. Because they only kept the base materials for four years, this could not be determined during this project at the regular farms of Jaap Vermeer and Herman Vermeer.

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