

Novitron® - A new wide-spectrum, pre-emergent herbicide solution for peas, beans and potatoes by FMC

Novitron® - Eine neue, breitwirksame Voraufbau-Herbizid-Lösung für Erbsen, Bohnen und Kartoffeln von FMC

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Summary

This report provides a summary of 59 efficacy and selectivity trials undertaken during the development of a new wide-spectrum, pre-emergent herbicide solution for peas, beans and potatoes. The trials were specifically designed to determine if the formulation could be used safely on the target crops as well as to analyze the spectrum of weed species controlled with this formulation.

The results from these trials have shown that Novitron is safe to apply as a pre-emergent herbicide on the target crops. The results have also shown that the product has excellent efficacy against the majority of weed species commonly found in the target crops.

Keywords: Aclonifen, clomazone, crop selectivity, efficacy, pre-emergent herbicide, weed spectrum

Zusammenfassung

Dieser Bericht stellt eine Zusammenfassung von 59 Versuchen zur Wirksamkeit und Selektivität dar, die im Zuge der Entwicklung einer neuen breitwirksamen Voraufbau Herbizid-Lösung für Erbsen, Bohnen und Kartoffeln durchgeführt wurden. Die Versuche wurden speziell entwickelt, um festzustellen, ob die Formulierung sicher für die Zielkulturen ist sowie zur Analyse des Spektrums der Unkrautarten die mit dieser Formulierung kontrolliert werden.

Die Ergebnisse aus diesen Studien haben gezeigt, dass Novitron als Voraufbauherbizid sicher in den Zielkulturen eingesetzt werden kann. Die Ergebnisse haben gezeigt, dass das Produkt eine hervorragende Wirksamkeit gegen die Mehrheit der Unkrautarten zeigt, die üblicherweise in den Kulturen gefunden werden.

Stichwörter: Aclonifen, Clomazone, Selektivität bei Kulturarten, Unkrautspektrum, Voraufbau-Herbizid, Wirksamkeit

1. Introduction

The objective of this report is to provide an overview of results obtained in a series of efficacy and selectivity trials undertaken during the development of the new pre-emergent herbicide Novitron. Novitron is a premixture of the herbicidal active ingredients, clomazone (30 g a.i./l) plus aclonifen (500 g a.i./l). The formulation is a water dispersible granule (WG) which is rapidly dissolved and dispersed when mixed with water.

All together, the trials cover the four requested professional applications in terms of the pre-emergence control of mono- and dicotyledonous weeds at the intended dose rate of 2.4 kg/ha used in cultivations of field beans, field peas (combining peas) / garden peas (vining peas) and potatoes.

All trials were located in areas representative of those where the respective crops are grown commonly. The trials covered a broad range of various soil and weather conditions consistent with the EPPO Standard PP 1/241 (Guidance on comparable climates). All countries and regions where trials were executed belong to the same EPPO region of comparable climate (maritime climate). Therefore, the results obtained from the different countries and regions are considered as comparable in terms of climatic conditions. Furthermore, the agronomic circumstances as well as the contemplable spectra of weeds commonly occurring in the respective crops are also considered as largely comparable for the above mentioned countries and regions. It is proposed that the Novitron formulation will have the following classifications according to the following Risk and Safety phrases:

- Dangerous for the environment (N)
- Irritant (Xi)
- Irritating to skin (R38)
- Very toxic to aquatic organisms, may cause long-term adverse effects (R50/53)
- Keep out of reach of children (S2)
- Keep away from food, drink and animal feeding stuffs (S13)
- When using do not eat, drink or smoke (S20/21)
- Avoid contact with skin (S24)
- To avoid contamination of the environment using appropriate container (S57)
- To avoid risks to human health and the environment, the instructions for use (SP001)

Due to Novitron's highly efficacious activity on a wide spectrum of weed species, detailed advice on the label of Novitron are required to safeguard against any off-target effects which may occur during application of the product. The wording of such advice should also focus on the avoidance of adverse effects on adjacent crops including other plants. Therefore, the following label recommendations are proposed for Novitron:

- To minimize the risk of unintended contaminations of adjacent crops and plants as well as non-target areas during the application, strict attention is to be paid to drift avoidance because of possible phytotoxic effects on adjacent growing sensitive plant species.
- On areas Novitron is used, appropriate intervals are to be observed to adjacent cropping areas in accordance with national requirements.
- The use of nozzle types classified as drift-reducing is strictly recommended.
- The product is to be applied in a water volume of not less than 200 l/ha.
- The product is not to be used under temperature conditions of ≥ 25 °C.
- Application is not to be made on dry cloddy seedbeds, or if a prolonged dry period is to be expected after the use of Novitron.

2. Materials and methods

The evaluation on efficacy and selectivity of Novitron is based on data issued from a total of 59 efficacy trials and 33 specially designed selectivity trials (1N vs. 2N) conducted during the years 2009 and 2010 in the EU countries Belgium (BE), Germany (DE), France (FR), the Netherlands (NL) and the United Kingdom (UK).

2.1 Efficacy Trials

The design of the trials was undertaken in accordance with the following format:

Design	Randomised complete block
Untreated	Included in the blocks. Sufficient untreated area between the plots.
Replicates	4
Net plot size	Minimum 20 m ² and minimum 2 m width

According to the intended uses for Novitron (Tab. 1), the efficacy trials were undertaken to simulate the following Good Agricultural Practices (GAP):

Tab. 1 Proposed GAP for Novitron.

Tab. 1 *Vorgeschlagene GAP für Novitron.*

Agronomic practise	Novitron GAP
Area of use	Agriculture
Area of application	Field
Crop and/or situation	Field beans (VICFM) - Combining field beans; spring varieties
	Field peas (PIBSA) - Combining field peas; spring varieties
	Potatoes (SOLTU) - ware and consumer potatoes; seed potatoes

Agronomic practise	Novitron GAP
Pests / Group of pests	Mono- and dicotyledonous weeds
Time of application	Pre-emergence of crop and weeds
Max. number of applications / year / crop	1
Application method	Spraying, broadcast; no soil cultivation after application
Dose rate of product	2,4 kg/ha
Water volume	200-400 l/ha

Timing of efficacy evaluations undertaken on the various weed species present in the individual trials were undertaken four times during the efficacy trials. The timings were as follows:

1. After the formation of the first true leaf pair of the crop
2. Four weeks after application.
3. Before crop covering the soil
4. At maturity of the crop

During the assessment, the population of the weeds in the plots were recorded and compared to the untreated plots to provide the calculated efficacy value of each treatment.

2.2 Selectivity Trials

2.2.1 Phytotoxicity

For all trials evaluating phytotoxicity on peas, beans and potatoes, Novitron was applied pre-emergence of the crop at 1N (2.4 kg) and 2N (4.8 kg) rates. Assessments on phytotoxicity were carried out at several times after application and comprised mainly parameters as number of plants, chlorotic and/or bleaching effects, crop vigour, growth reduction (stunting), and thinning. In some cases additional assessments were carried out on necrosis and on delay of emergence. Depending on the parameter to be rated, assessments were done either by counting plants on defined areas per plot, or by estimation of the occurring effect on a whole plot basis in comparison to the corresponding untreated control plot. Countings were reported as absolute values while estimated effects were reported either as percentage values based on the incidence and severity of the rated effect, or as index values according to a 0-10 or 1-10 scale with 0/1 = all plants affected, all plants dead, and 10 = no visible effect, all plants in good condition.

2.2.2 Yield

Spring field peas and beans: In terms of quality parameters for all treatments of each selectivity trial, the thousand grain weight (TGW) was assessed at harvest. For the data evaluation the reported absolute values were converted for each treatment into percentage relative to the untreated control (UTC) to get a basis of comparison without the influence of the tested cultivars.

Potatoes: For each treatment in the selectivity trials, plots were harvested at maturity to establish the respective yields in metric tonnes/hectare. For the data evaluation, the absolute values were reported were converted from mT/ha into percentage relative to the UTC to get a basis of comparison without the influence of the tested cultivars.

3. Results

3.1 Efficacy

3.1.1 Peas and beans

As result of the evaluation and based on the efficacy data rated for the individual weed species at the mean time of approximately 10-11 weeks after application, the following efficacy classification could be derived from the pooled evaluation of weeds in peas and beans.

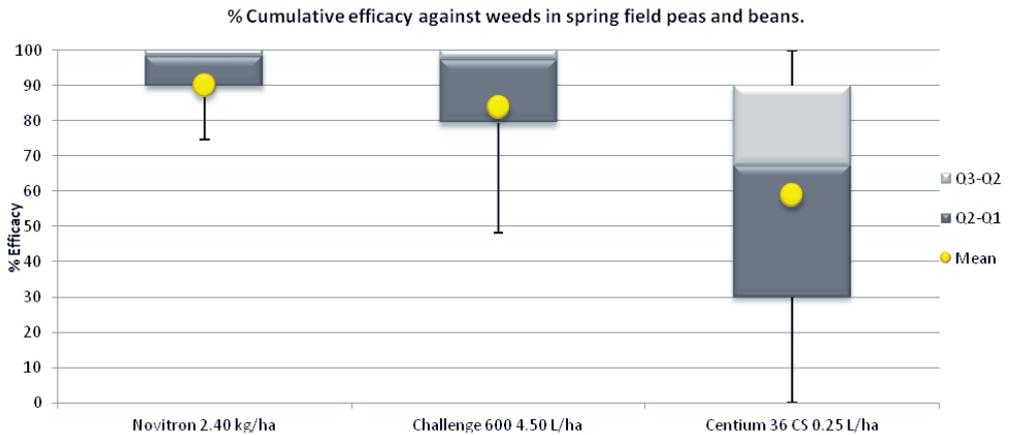
Tab. 2 Summarised efficacy results of Novitron on various weed species in spring field peas and spring field beans.

Tab. 2 Zusammengefasste Ergebnisse zur Wirksamkeit von Novitron auf verschiedenen Unkrautarten im Frühjahr in Futtererbsen und Ackerbohnen.

Efficacy rating (% mean control)	EPPO codes for weeds encountered in efficacy trials				
Excellent (98,0 – 100 %)	BRSNW*	CAPBP	LAMPU	MATIN	MATSS
	MYOAR	PAPRH	POLLA	POLSS	RAPRA
	SINAR	SONAR	THLAR	VERAR	VERPE
Good (95,0 - 97,9 %)	MATCH	POLPE	SENVU	STEME	
	AETCY	ALOMY	ATXPA	AVEFA	BEAVA*
Sufficient (80,0 - 94,9 %)	BRSNN *	CHEAL	GALAP	LOLMG	MERAN
	POAAN	POLAV	POLCO	SOLNI	VERHE
	VIOAR	VIOTR			
Insufficient (< 80,0 %)	ARTVU	FUMOF	LOLPE	RORSY	

*volunteer crops

For the vast majority of all weed species taken into account, Novitron provided a sufficient to excellent control level (80 %-100 %). Therefore, Novitron can be considered as suitable to ensure an effective and reliable weed control in field bean and pea crops (combining and canning peas) if the product is applied one-time at the dose of 2.4 kg/ha in spring.



	Novitron 2.40 kg/ha	Challenge 600 4.50 l/ha	Centium 36 CS 0.25 l/ha
Min	0	0	0
25th	89,8	79,3	30,0
Median	98,1	97,5	67,5
75th	100,0	100,0	90,0
Max	100,0	100,0	100,0
Mean	90,0	83,7	58,7
SD	19,0	25,5	34,0
N	156	156	96

Fig. 1 Cumulated efficacy results of Novitron against all weeds in spring field peas and spring field beans.

Fig. 1 Kumulierte Ergebnisse zur Wirksamkeit von Novitron gegen alle Unkräuter im Frühjahr in Futtererbsen und Ackerbohnen.

3.1.2 Potatoes

Because the agricultural conditions for potato growing and the usually occurring spectrum of weed species may be different to some extent in comparison to situations in field bean and pea crops, the efficacy data obtained from field trials executed in potato crops were separately evaluated.

Derived from the efficacy data rated for the individual weed species at the mean time of approximately eight weeks after application, the following efficacy classification resulted from the evaluation:

Tab. 3 Summarized efficacy results of Novitron on various weed species in spring potatoes.

Tab. 3 Zusammengefasste Ergebnisse zur Wirksamkeit von Novitron auf verschiedenen Unkrautarten im Frühjahr in Kartoffeln.

Efficacy rating (% mean control)	EPPO codes for weeds encountered in efficacy trials				
Excellent (98,0 – 100 %)	AMARE	BRSNW*	CAPBP	CHEAL	CONAR
	DATST	EPHHE	FUMOF	GALAP	MATCH
	MERAN	POAAN	POLAV	POLCO	POLPE
	SENVU	SINAR	STEME	VIOAR	
Good (95,0 - 97,9 %)	SOLNI				
Sufficient (80,0 - 94,9 %)	ACETY	DIGSA	LAMPU	ECHCG	

* volunteer crops

Therefore, against all weed species taken into account, excellent control ($\geq 98.0\%$) was achieved against the vast majority of weed species. Therefore, Novitron can be said to be suitable to ensure an effective and reliable weed control in potato cultivations if the product is applied one-time at the dose of 2.4 kg/ha in advanced spring.

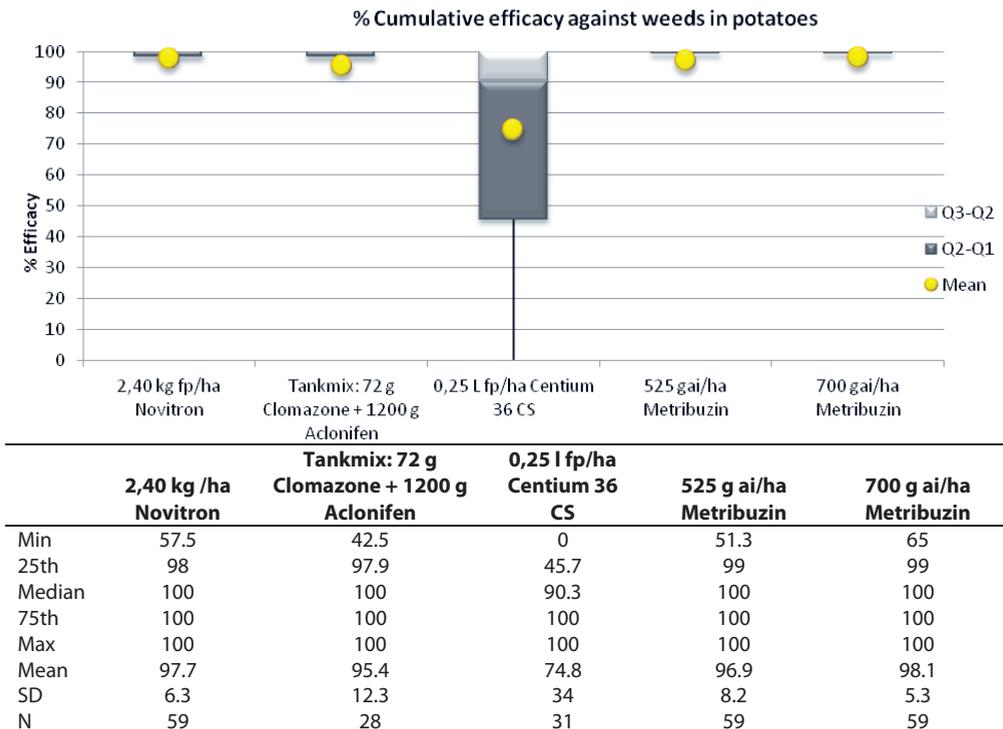


Fig. 2 Cumulated efficacy results of Novitron against all weeds in potatoes.

Fig. 2 Kumulierte Ergebnisse zur Wirksamkeit von Novitron gegen alle Unkräuter in Kartoffeln.

3.2 Crop Safety

3.2.1 Spring field peas and beans

In view of phytotoxicity to the host crop findings, Novitron can be considered to be safe to the respective crops to a large extent if the product is used according to the use specifications. Phytotoxic responses as bleaching effects, slight reduction of crop vigour of growth can occur from time to time if the product is used under certain conditions on the intended crops. Those effects normally are transient and grow out during the course of the vegetation period without leaving severe or lasting damages on the crop and without any adverse effects on the quantity or quality of yield.

As the result of the evaluation, only in a very few cases phytotoxic responses on crops were observed for the target treatment of Novitron, mostly evident as bleaching effects. In the double target rate of 4.8 kg/ha variant, phytotoxic effects had occurred slightly more, but all in all the incidence over all efficacy and selectivity was absolutely within passable limits as well for the higher dosed treatments. The observed effects were transient in all cases and have grown out during the course of the vegetation period without leaving severe or lasting damages on the crop and without any adverse effects on the quantity or quality of yield.

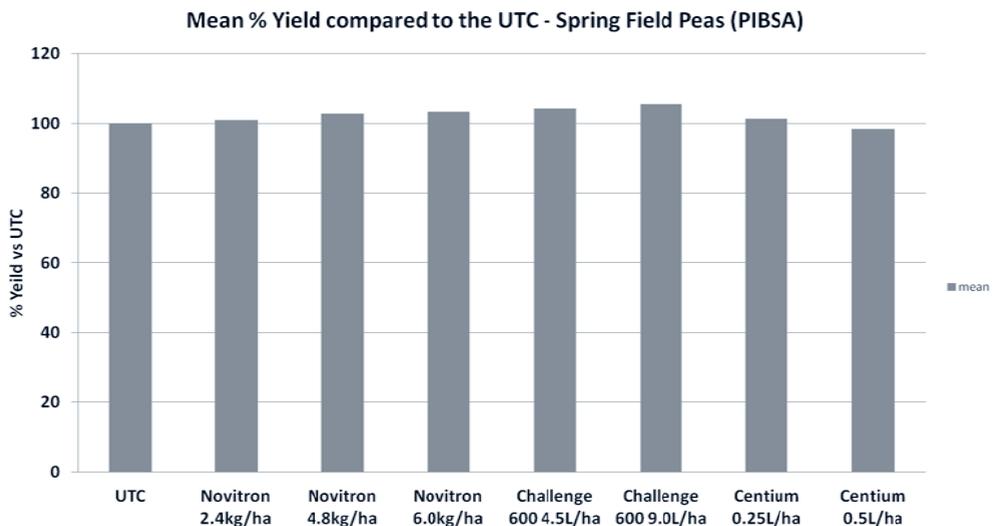


Fig. 3 Mean % yield of spring field peas compared to untreated control.

Fig. 3 Mittlerer % Ertrag von Erbsen im Vergleich zur unbehandelten Kontrolle.

For spring field peas, Novitron applied up to a dose of 6.0 kg/ha pre-emergence on PIBSA can be said to have no impact on the yield. In some cases where phytotoxic effects were observed after crop emergence, they were transient and had no influence on the assessed yield quality parameters.

It is reasonable to say that there was no impact apparent on the yield of spring field beans after one pre-emergence application of Novitron. In some cases where phytotoxic effects were observed after crop emergence, they were transient and had no influence on the assessed yield quality parameters. So, from the yield quality point of view the product can be considered as safe for VICFM crops. The results show that Novitron applied up to a dose of 6.0 kg/ha pre-emergence of crop has no impact on the mentioned parameters of yield quantity and quality. In terms of yield, the product therefore can be considered as safe.

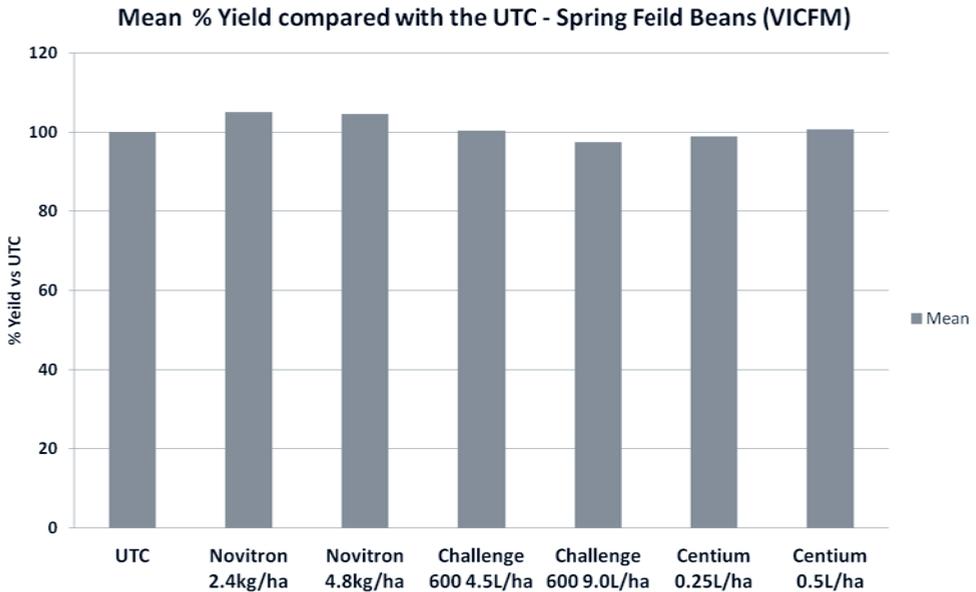


Fig. 4 Mean % yield of spring field beans compared to untreated control.

Fig. 4 Mittlerer % Ertrag von Sommer-Ackerbohnen im Vergleich zur unbehandelten Kontrolle.

3.2.2 Potatoes

All in all, the incidence of phytotoxic responses over all efficacy and selectivity trials can be said to be low on the tested potato crops and absolutely within acceptable limits for herbicide treatments. In most cases, any signs of pytoxicity were transient and have grown out during the course of the vegetation period without leaving severe or lasting damages on the crop and without any adverse effects on the quantity or quality of yield.

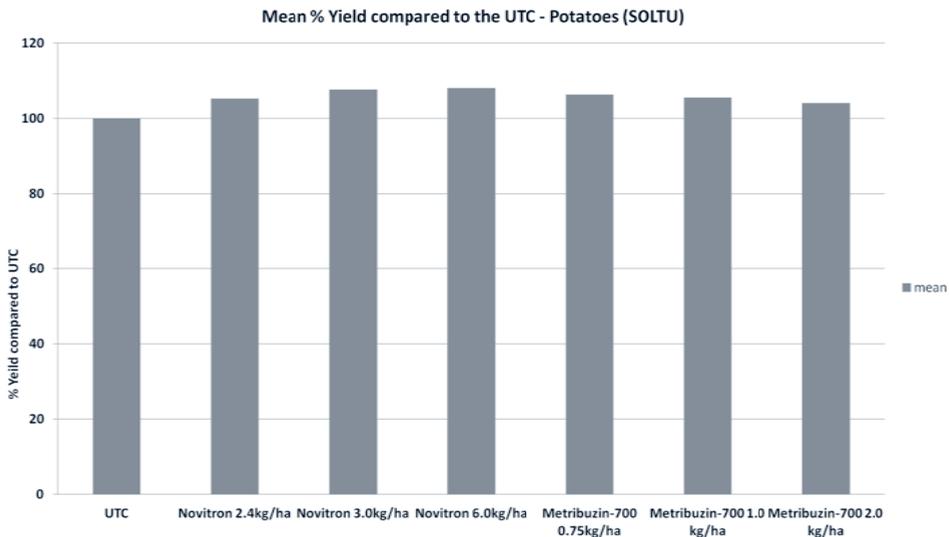


Fig. 5 Mean % yield of potatoes compared to untreated control.

Fig. 5 Mittlerer % Ertrag von Kartoffeln im Vergleich zur unbehandelten Kontrolle.

Novitron applied up to a dose of 6.0 kg/ha pre-emergence can be said to be safe for potato crops and has absolutely no impact on yield quality parameters as tuber size and starch content.

4. Discussion

In conclusion, from the results of the trials undertaken, it is clear that Novitron can provide excellent pre-emergent weed control against a wide-spectrum of weed species. The trial results have also proven that Novitron is safe to apply in spring field peas, spring field beans and potatoes when used in accordance with label instructions at an application rate of 2.4 kg/ha. This series of trials has also proven that the formulation provides similar efficacy across a wide range of soil types within the maritime climatic zone of Europe.

References

EUROPEAN AND MEDITERRANEAN PLANT PROTECTION ORGANIZATION (EPPO), 2005: EPPO STANDARD PP 1/241. GUIDANCE ON COMPARABLE CLIMATES.