The protective role of ComCat® in crops when applied together with herbicides

Introduction

Weed control is an essential practice that reduces competition between crops and weeds for water and nutrients, and in some cases even for light. Some may release toxic chemicals, which may adversely affect crop growth. It has been shown repeatedly that even hoeing of weeds by hand can lead to reduced competition that, in turn, lead to increased yields. However, mechanical weed control has been mainly replaced by chemical weed control in the modern era. Today many chemical herbicides have been developed for broad-leaf weeds as well as unwanted grass.

Since the origin of chemical herbicides, and its increasing application, new information has been collected. One piece of information, that is rather disturbing and defies the odds, involves the possible negative effect that both pre- and post-emergence application of chemical herbicides can have on crops. Sometimes the effect can be observed in terms of retarded vegetative growth, but mostly in terms of yield loss.

Agraforum GmbH is a company that develops natural products for the agricultural market. One of these products, a bio-stimulant or plant strengthening agent named ComCat®, has been developed over a 20-year research period. Results over many seasons have shown that ComCat® not only increases the resistance of agricultural crops towards biotic and abiotic stress conditions but stimulates root production and vegetative growth that ultimately lead to higher yields. Because of these attributes, a series of trials by independent institutions were conducted to ascertain whether the addition of ComCat® to foliar applied herbicides can play a protective role towards crop plants. Answers to the following questions needed to be found:

1) Can ComCat® be foliar applied together with herbicides?
2) Will ComCat® not stimulate the weeds to grow better and defy the odds?
3) Will ComCat® applied together with herbicides still have an influence on yield?

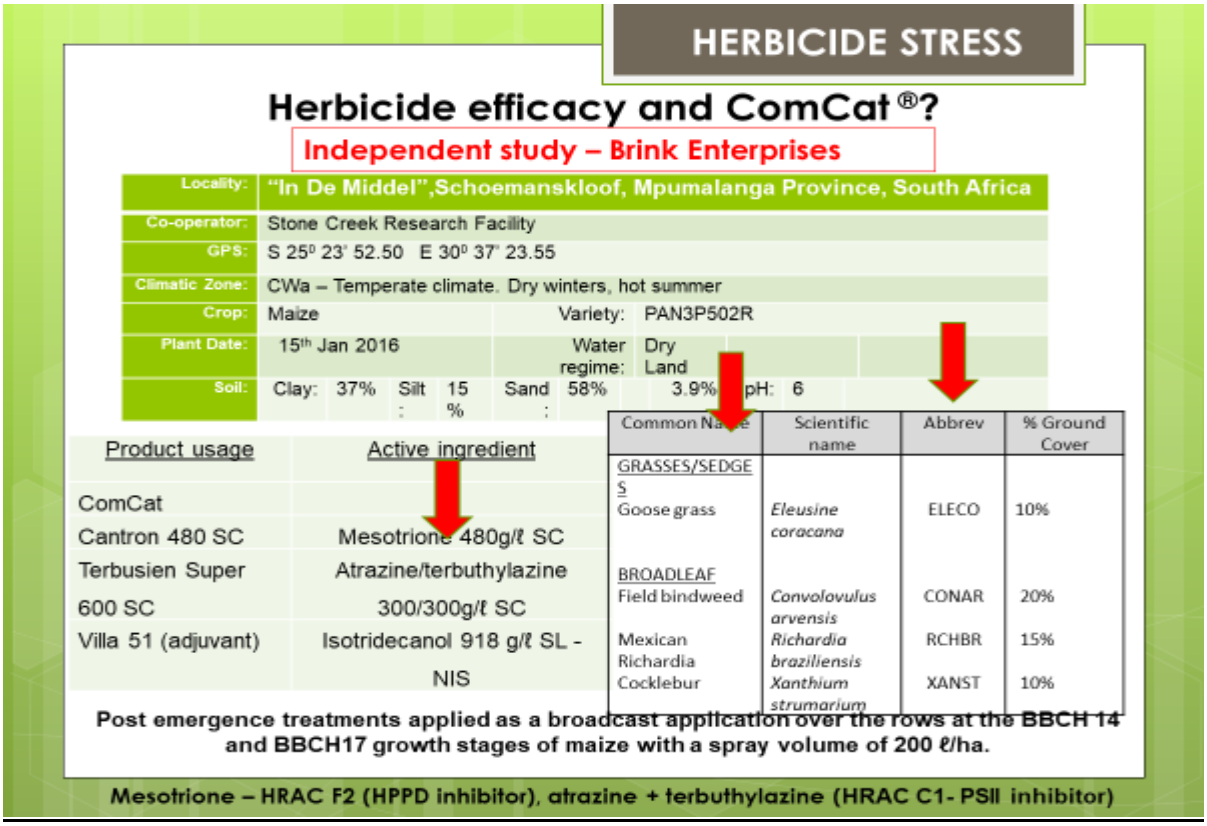
Answers supplied by research

Question 1: Can ComCat® be foliar applied together with herbicides?

The answer is **YES**. It can be added to the spray tank, not only together with herbicides, but also other chemicals such as fertilizers, insecticides and fungicides.

Question 2: **Will ComCat® not stimulate the weeds to grow better and defy the odds?**

Independent study by Brink Enterprises



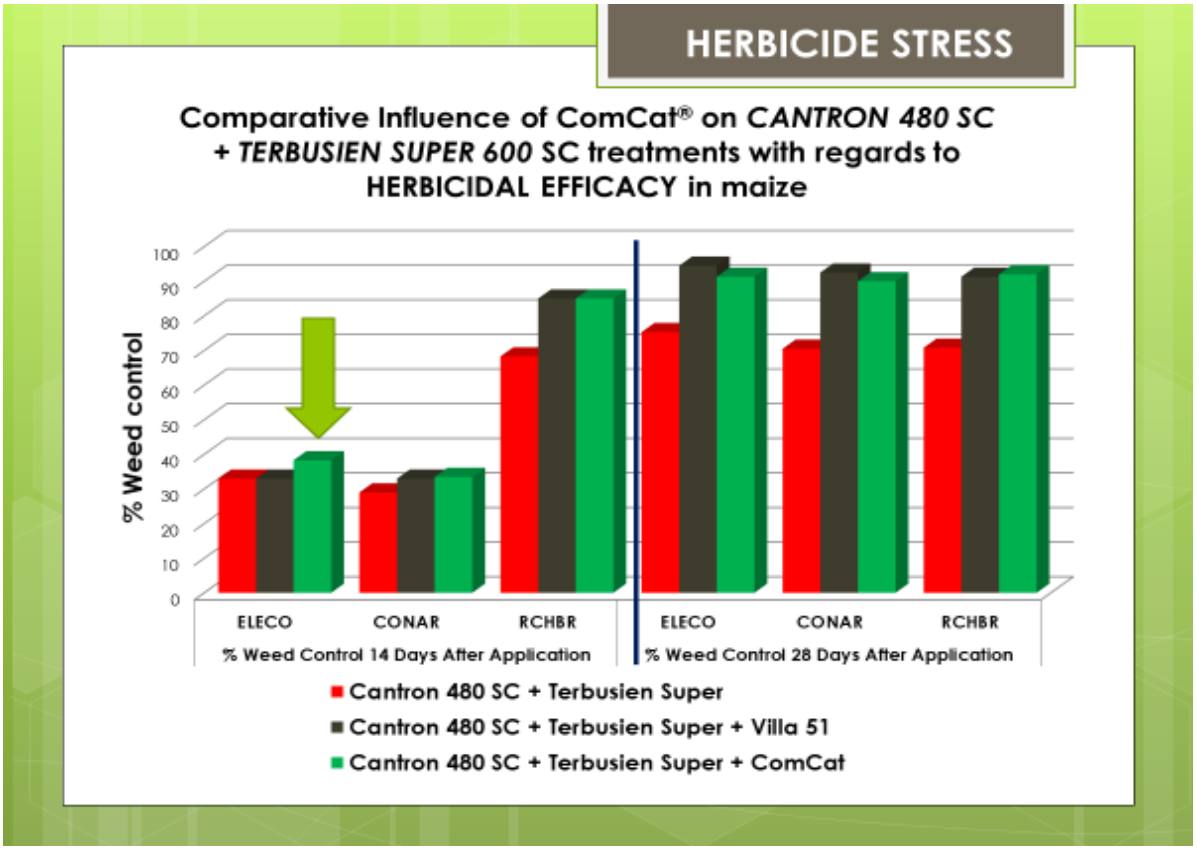
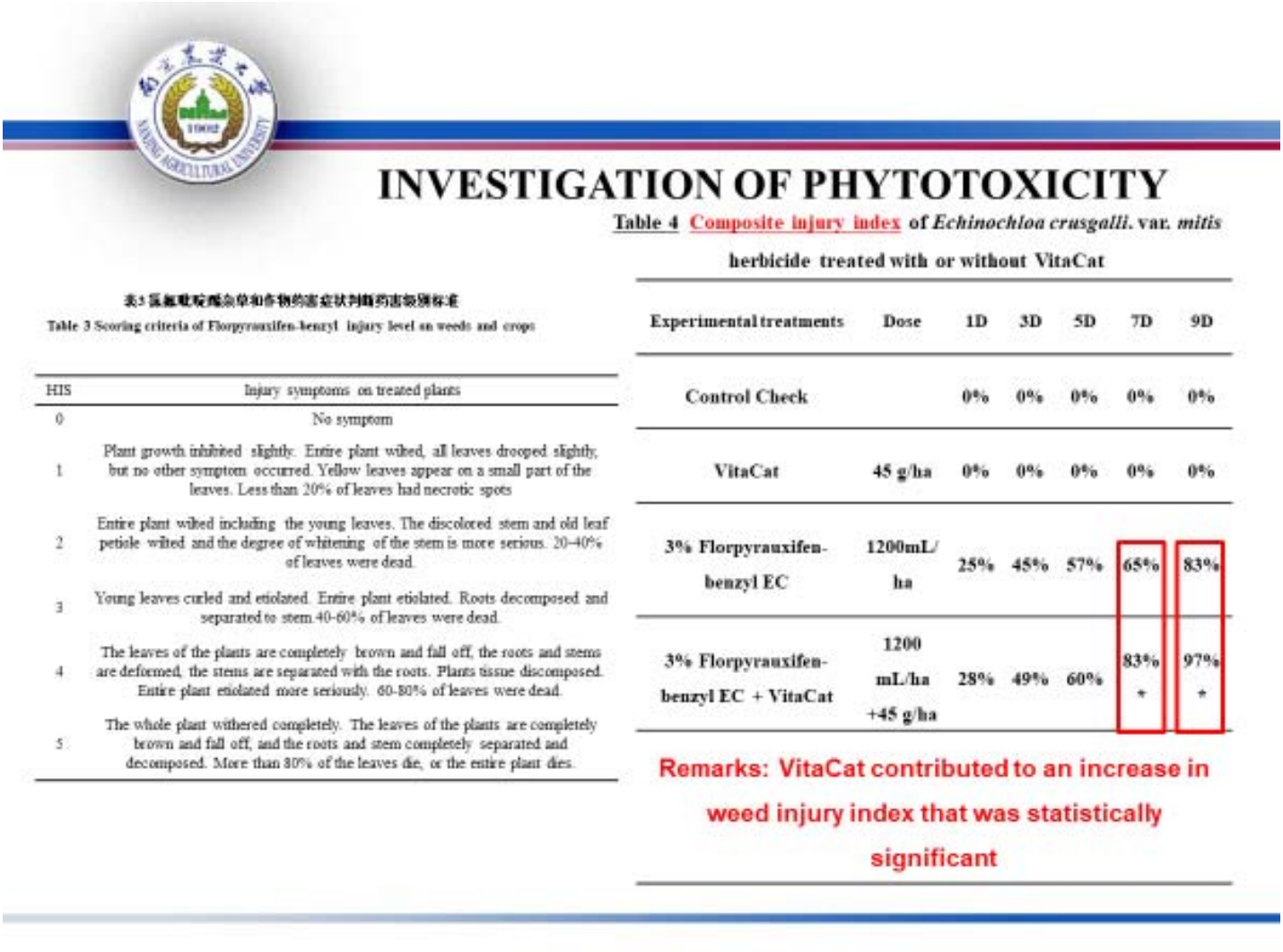


Figure 1: The influence of ComCat®, added to different herbicides, on % weed control.

The results in **Figure 1** confirmed that the addition of Villa 51 (black column), a wetter, as well as ComCat® (green column) did not result in stimulating weed growth compared to the control of all three weeds by Cantron 480 SC + Terbusien Super after 14 and 28 days. This answers question 2 namely that the addition of ComCat® does not benefit the weeds which might lead to higher resistance towards the herbicide. A possible explanation is that the stimulation of vegetative growth in weeds, leading to active dividing meristematic tissues, sensitizes the weeds to herbicide attack rather than the opposite. It is known that herbicides work best on actively growing weeds (https://www.kzndard.gov.za/images/Documents/Horticulture/Veg_prod/weed_control.pdf)

Independent study 1 in rice by Nanjing Agricultural University in China



INVESTIGATION OF PHYTOTOXICITY

Table 3 Scoring criteria of Florpyrauxifen-benzyl injury level on weeds and crops

HIS	Injury symptoms on treated plants
0	No symptom
1	Plant growth inhibited slightly. Entire plant wilted, all leaves drooped slightly, but no other symptom occurred. Yellow leaves appear on a small part of the leaves. Less than 20% of leaves had necrotic spots
2	Entire plant wilted including the young leaves. The discolored stem and old leaf petiole wilted and the degree of whitening of the stem is more serious. 20-40% of leaves were dead.
3	Young leaves curled and etiolated. Entire plant etiolated. Roots decomposed and separated to stem.40-60% of leaves were dead.
4	The leaves of the plants are completely brown and fall off, the roots and stems are deformed, the stems are separated with the roots. Plants tissue discomposed. Entire plant etiolated more seriously. 60-80% of leaves were dead.
5	The whole plant withered completely. The leaves of the plants are completely brown and fall off, and the roots and stem completely separated and decomposed. More than 80% of the leaves die, or the entire plant dies.

Table 4 Composite injury index of *Echinochloa crusgalli*. var. *mitis* herbicide treated with or without VitaCat

Experimental treatments	Dose	1D	3D	5D	7D	9D
Control Check		0%	0%	0%	0%	0%
VitaCat	45 g/ha	0%	0%	0%	0%	0%
3% Florpyrauxifen-benzyl EC	1200mL/ha	25%	45%	57%	65%	83%
3% Florpyrauxifen-benzyl EC + VitaCat	1200 mL/ha +45 g/ha	28%	49%	60%	83% *	97% *

Remarks: VitaCat contributed to an increase in weed injury index that was statistically significant

Table 1: Composite injury index of Barnyard grass, *Echinochloa crusgalli*, a weed in rice, treated with the herbicide Florpyrauxifen benzyl EC, in the absence (control) and presence of VitaCat® (name for ComCat®, in China).

After 7 days and up to 9 days the addition of ComCat® to Florpyrauxifen benzyl EC increased its herbicidal efficacy significantly (**Table 1**; red squares). This confirms the independent study of Brink

Enterprises namely that ComCat® does not benefit the weeds, but rather sensitizes it towards herbicide attack.

Question 3: Will ComCat® applied together with herbicides still have an influence on yield?

Today both selective and non-selective herbicides are available on the market and to choose the right one is essential. Moreover, herbicide can remain in soil as residuals for a period of time. Several herbicides can be excessively persistent even when used at label-approved rates. Atrazine, Diphenamid, Metribuzin and Trifluralin are examples of chemicals which have a long residual effect and may affect susceptible crops grown later in the rotation.

This effect can be seen in reduced yields when it is too late (https://www.kzndard.gov.za/images/Documents/Horticulture/Veg_prod/weed_control.pdf). It has, therefore, become essential for farmers to be aware of the possible negative effect chemical herbicides can have on crop yields. ComCat® is known to promote yield in a variety of row, vegetable and fruit crops. The question that must be answered is whether it can maintain this attribute when applied together with herbicides.

Agraforum SA: Large scale test-check under rainfed conditions (South Africa)

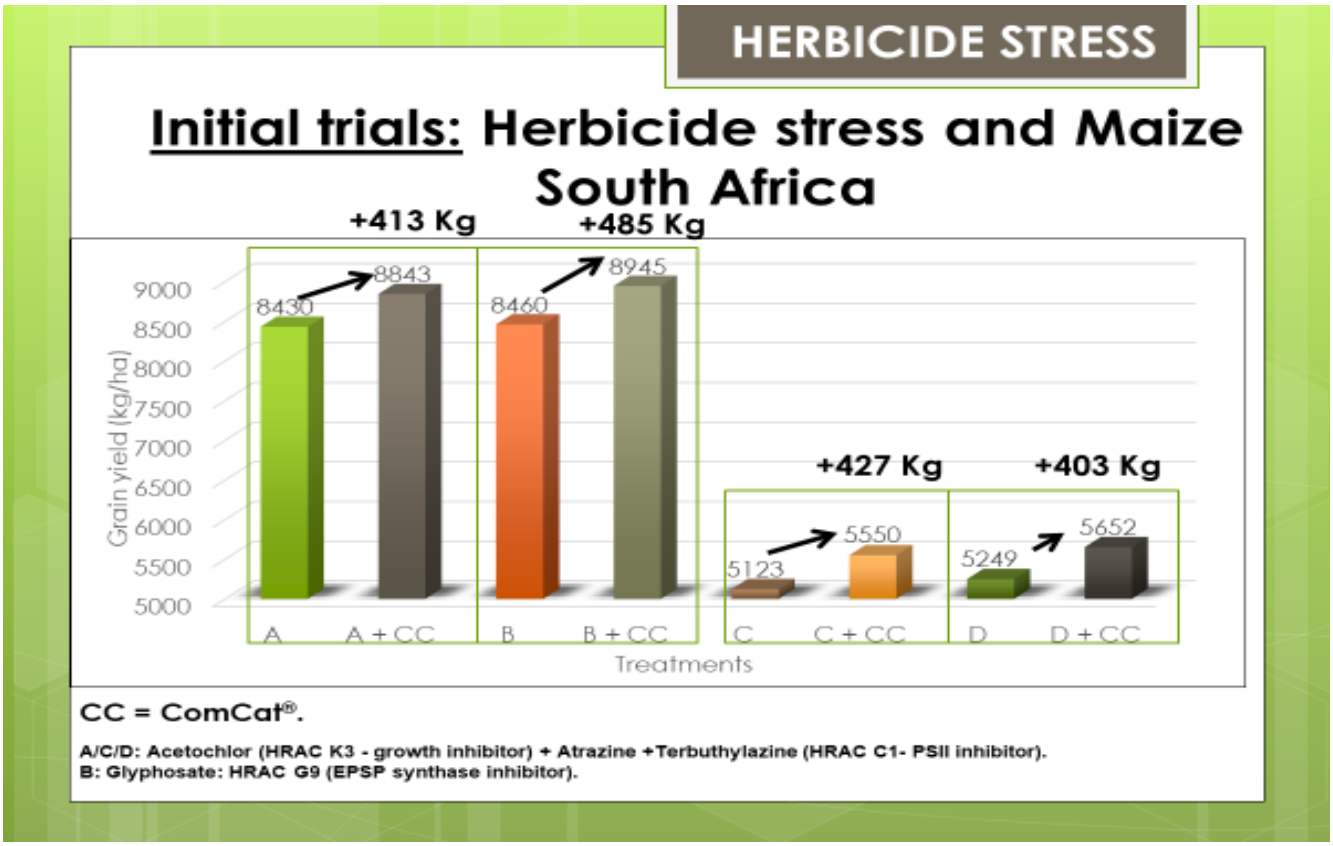


Figure 2: The yield response of maize after herbicide treatment in the absence (control) and presence of ComCat® in two separate trials under rainfed conditions. Post-emergence herbicide treatment was applied at the 10-leave stage.

The postulate at the onset of these test-checks was that the attributes of ComCat® might contribute to protection of the maize crop and prevent yield loss that is often experienced by farmers when post-emergence herbicides are foliar applied broadcast. Surprisingly, the addition of ComCat® to three different herbicides increased the maize yield significantly **(Fig 2)**. The first attempt to answer question 3 supplied sufficient confirmatory information. A second study was undertaken to verify these results.

Independent study 2 in rice by Nanjing Agricultural University in China

Yield characteristics of rice

Treatments	height (cm)	flag leaf area (cm^2)	tiller number	panicle length (cm)	number of full grains per panicle	seed setting rate (%)	thousand grain weight (g)	grain weight per plant (g)	theoretical yield (kg/mu)
Control	127.87±1.46b	58.52±2.2b	8.89±0.38c	23.32±1.08b	110.33±18.03b	82.69±5.19b	30.74±0.95b	45.09±	1002.94±40.86b
VitaCat	147.13±1.35a	67.97±2.74a	12.22±0.77a	28.27±1.47a	128.56±8.18a	87.15±1.76a	33.39±1.68a	48.2±1.81a	1185.53±40.23a
3% Florpyrauxifen-benzyl EC	127.37±3.94b	57.9±6.57b	9.33±1.53bc	22.41±2.18b	97.67±7.23b	77.14±2.44b	28.13±1.67c	44.53±	973.98±100.2b
3% Florpyrauxifen-benzyl EC + VitaCat	131.63±4.71b	65.74±4.44ab	11.22±1.35ab	24.9±1.45b	115.78±7.37a	84.27±1.84a	32.02±0.6ab	49.64±3.97a	1184.08±83.1a

Note: Significance of difference between different lowercase letters at 0.05 level.

Effects on yield characteristics of rice treated with 3% Florpyrauxifen-benzyl EC (1200 mL/ha) ± VitaCat (45 g/ha)

Table 2: Effect of ComCat® applied together with Florpyrauxifen-benzyl EC on the yield characteristics of rice.

In the absence of ComCat® the herbicide had a decreasing effect on rice yield, but in its presence yield loss was prevented **(Table 2)**.

University of the Free State (South Africa): The effect of herbicide residues in soil on dry matter accumulation in seedlings of legume crops

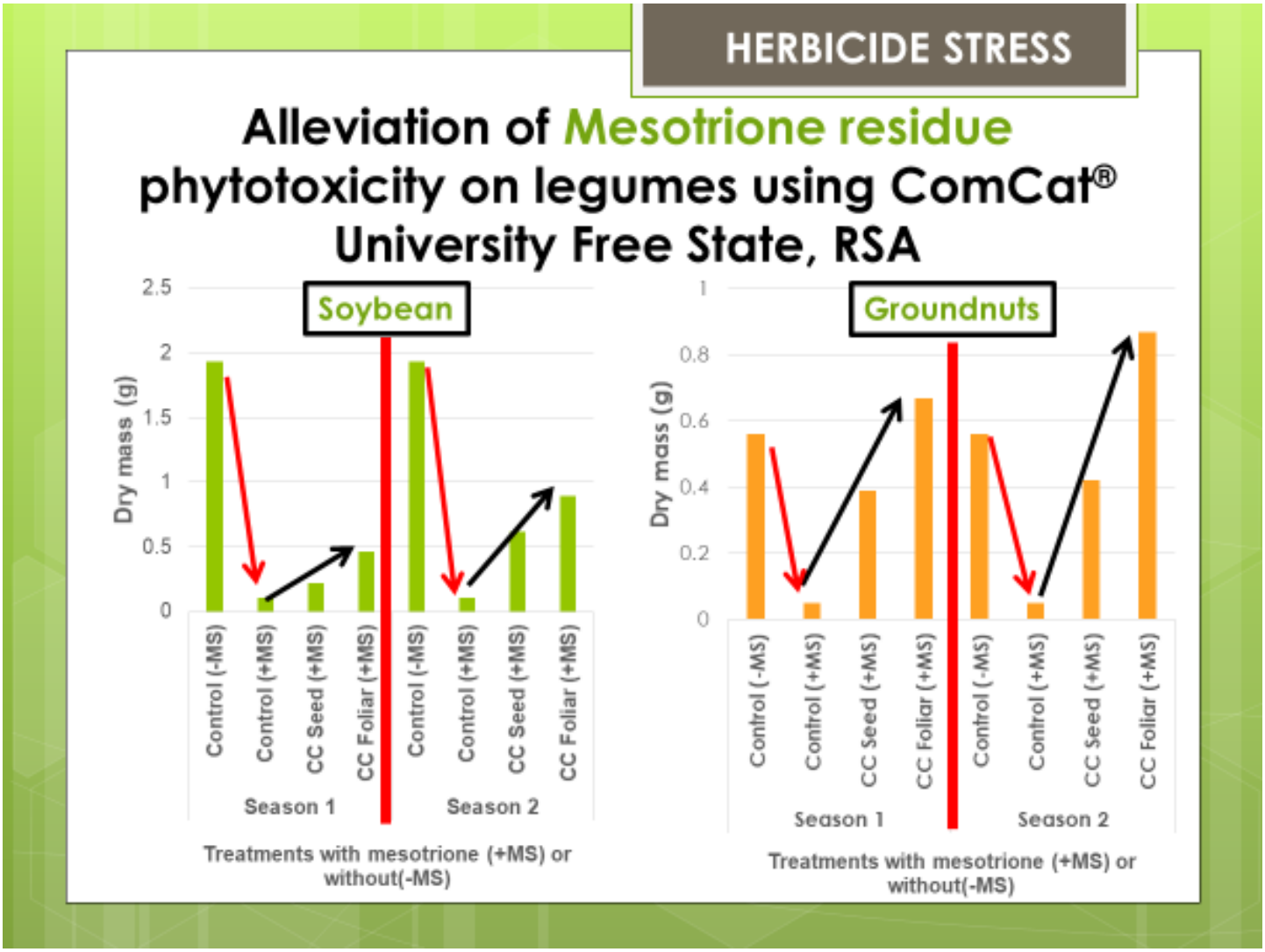


Figure 3: Effect of ComCat® on seedling growth of soybean and groundnuts grown in soil containing Mesotrione residues over two seasons. ComCat® was applied either as a seed treatment at planting or foliar after seedlings emerged. No herbicide (-MS) and herbicide only (+MS) served as controls.

During season 1 the same tendency was observed for both soybean and groundnuts, but much more marked in the latter **(Fig 3)**. Mesotrione residues in the soil significantly inhibited dry matter accumulation in seedlings while both seed treatment and foliar application with ComCat® tended to restore dry matter accumulation in both test crops. However, foliar application after seedling emergence clearly had the most pronounced affect. During season 2 this tendency was confirmed.

Plum Agrochemical Consulting and Service Co. Ltd, China: Growth of vegetatitive and reproductive parts in rice seedlings

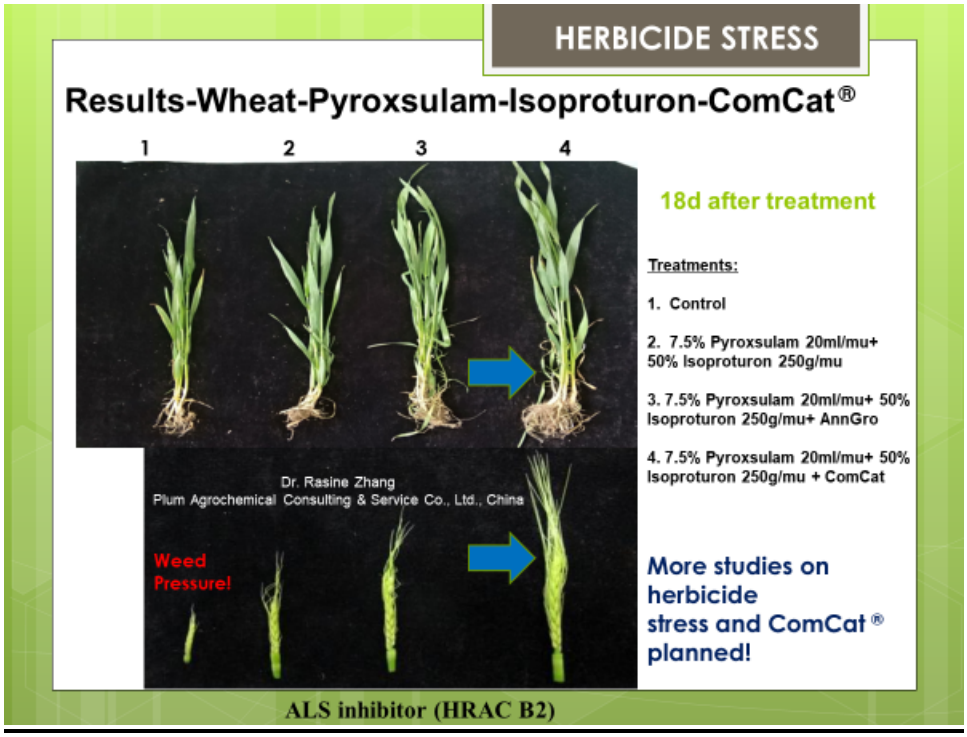


Plate 1: Qualitative demonstration of the herbicidal effect on the growth of vegetative and reproductive parts in rice seedlings grown in the presence **(blue arrows)** and absence of ComCat®, 18 days after application. Both vegetative and reproductive organ growth were positively influenced.

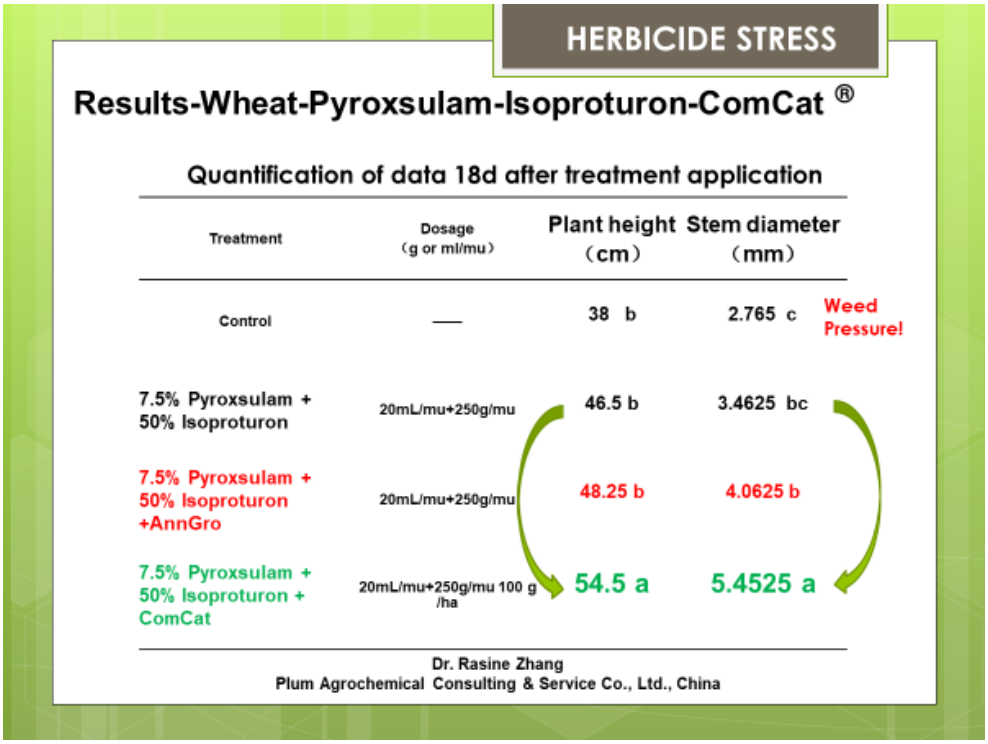


Table 3: Quantification of rice seedling growth in terms of plant height and stem diameter as demonstrated in Plate 1. Both plant height and stem diameter increased where ComCat® was added to the herbicide.

Conclusion

From the results presented in this document it is safe to say that:

1) ComCat® can be applied foliar together with different herbicides,
2) The presence of ComCat® in the herbicide spray tank will not benefit weeds in the sense that it would enhance its growth and perhaps also its resistance towards herbicide action.
3) It is common knowledge that herbicides might have a slight decreasing effect on yield of certain crops where herbicides are foliar applied covering also the crops. This is due to a degree of herbicide stress enforced onto the crops. On the other hand, ComCat® is known to enhance crop yields in a variety of row, vegetable and fruit crops. It has been shown that application thereof together with a herbicide can either prevent yield loss due to herbicide stress or even enhance crop yields significantly in some instances.