

Management of Clubroot (*Plasmodiophora brassicae*) with Surfactants, Fungicides and Lime

Venkat Chapara

Objective: To determine the effect of surfactant (ORO-79) alone, and in combination with fungicides and beet lime to manage clubroot on canola.

Methods: The following treatments (Table 1) were tested alone and along with a surfactant (ORO-79) in a randomized complete block design (RCBD) with four replications under field conditions. The field has natural soil population of *P. brassicae* of 5.5 million resting spores/g of soil. Treatments of ORO-79, an experimental, Ranman®, and Allegro® were applied in-furrow as soil drenches just before planting at the rate mentioned in Table 1. Whereas, beet lime was incorporated at a depth of 4-6 inches a week before planting. A susceptible canola cultivar to clubroot ‘DKL 30-42’ was planted at a depth of a half inch. Beet lime was acquired from American Crystal Sugar Company in Drayton, ND. The trial was planted the first week of June and was evaluated the first week of August (exactly 60 days after planting) at growth stage BBCH-65.

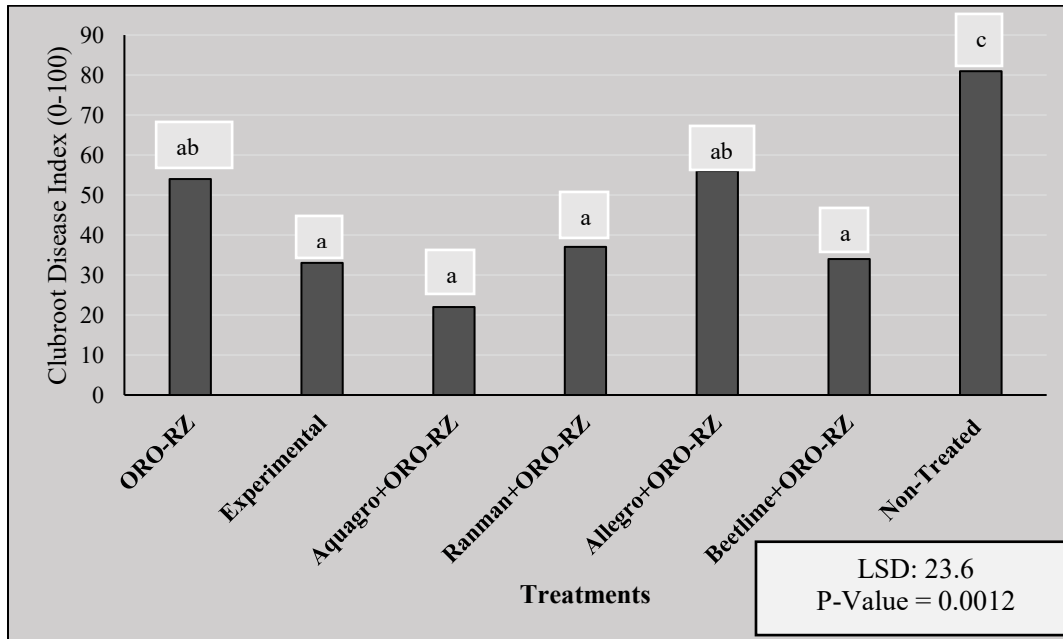
Rating scale: Clubroot rating scale: 0 = no galling, 1 = a few small galls (small galls on less than 1/3 of roots), 2 = moderate galling (small to medium-sized galls on 1/3 to 2/3 of roots), 3 = severe galling (medium to large-sized galls on more than 2/3 of roots). This rating scale was used for disease ratings of incidence and severity. A Clubroot Disease Index (CRDI) has been calculated using the incidence and severity data of clubroot samples obtained.

Soil sampling to determine pH: Soil samples were collected from all the plots before application of soil treatments and on the day of clubroot evaluations to know the effect of unit change in pH and their impact on clubroot control.

Table 1: List of treatments and the rates at which they were applied in soil.

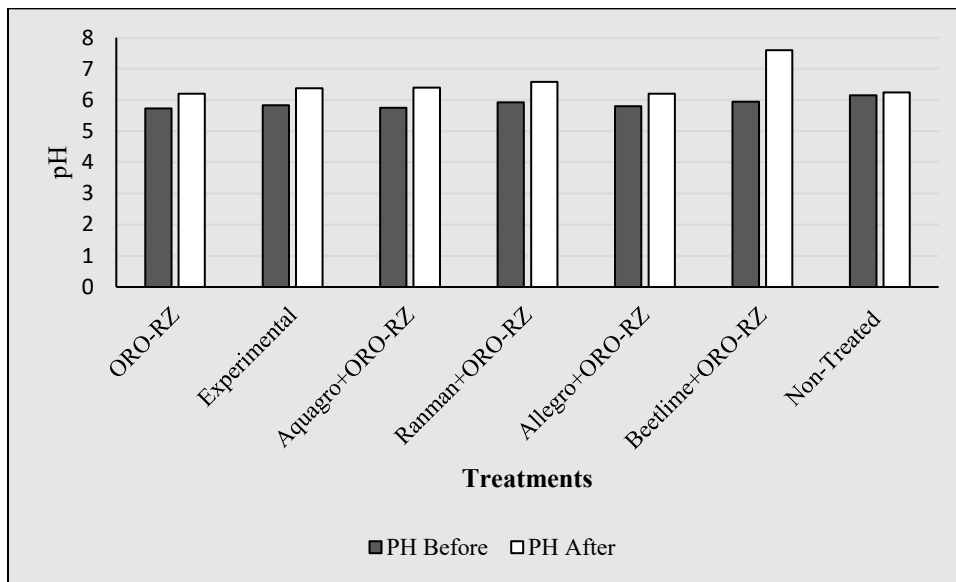
Treatments	Rate
ORO-RZ	32 oz/a
Experimental	10 oz/a
Aquagro + ORO-RZ	15.5g per 5ft row+ 32 oz/a
Ranman + ORO-RZ	25 + 32 oz/a
Allegro + ORO-RZ	11.6 ml/2litres + 32 oz/a
Beet lime + ORO-RZ	7.5 t/ha + 32 oz/a
Non-Treated	Check

Figure 1: Mean clubroot disease index (CRDI) observed on application of various in-furrow applied treatments.



*Bars followed by the same letter are not significantly different according to the LSD test ($p \leq 0.05$).

Figure 2: Observed change in soil pH before and after application of the treatments.



Results: The clubroot disease indexes (CRDI) of all the tested treatments were significantly different from the non-treated check (81%). A combination treatment of two surfactants (Aquagro + ORO-RZ) had lower CRDI (22%) followed by a new experimental biological alone (33%), Beet lime + ORO-RZ (34%) and Ranman + ORO-79 (37%) (Figure 1). These results indicate that the surfactants and biological products can be considered for patch management of clubroot on canola in solo or in combination.

Soil pH: The treatment of beet lime + ORO-RZ showed a significant increase of 1.6 units of pH compared to before application.

Efficacy of a Surfactant (ORO-79) in Various Rates with the Presence and Absence of Lime to Manage Clubroot on Canola

Venkat Chapara

Objective: To determine the efficacy of a surfactant (ORO-79) in various rates in the presence and the absence of lime to manage clubroot on canola.

Methods: The surfactant ORO-79 was tested in different application rates to manage clubroot under the influence of lime and without lime. The experiment was laid out under field conditions in a split-plot arrangement (where the main plots are lime and without lime; and the subplots are treatments). The trial was replicated four times. The field has natural soil population of *P. brassicae* of 5.5 million resting spores/g of soil. Different rates of the surfactant ORO-79, were compared with treatments of the non-treated check. A combination treatment of the fungicide Ranman® and ORO-79 was a new surfactant ORO-09 (Table 1). The treatment of lime was incorporated at a depth of 4-6 inches a week before planting, and the treatments of surfactant were applied right before planting in the form of soil drench. A susceptible canola cultivar to clubroot ‘Invigor L233P’ was planted at a depth of a half inch. Lime was acquired from the Langdon land fill station (a by-product of lime sludge from the Langdon water plant). The trial was planted in the first week of June and evaluated the first week of August (exactly 60 days after planting) at growth stage BBCH-65.

Rating scale: Clubroot rating scale: 0 = no galling, 1 = a few small galls (small galls on less than 1/3 of roots), 2 = moderate galling (small to medium-sized galls on 1/3 to 2/3 of roots), 3 = severe galling (medium to large-sized galls on more than 2/3 of roots) was used for disease rating of incidence and severity. A Clubroot Disease Index (CRDI) has been calculated using the incidence and severity data of clubroot obtained.

Table 1: List of treatments in main plots and sub-plots that were tested in the trial.

Main Plot	Sub-plot	Rate
Lime	ORO-09	2 pt/a
Lime	ORO-79	8 pt/a
Lime	ORO-79	4 pt/a
Lime	ORO-79	2 pt/a
Lime	Non-Treated	Check
Lime	Ranman + ORO-79	25 fl oz + 2 pt/a
Without Lime	ORO-09	2 pt/a
Without Lime	ORO-79	8 pt/a
Without Lime	ORO-79	4 pt/a
Without Lime	ORO-79	2 pt/a
Without Lime	Non-Treated	Check
Without Lime	Ranman + ORO-79	25 fl oz + 2 pt/a

Table 2: The effect of ORO-79 at various rates on the mean clubroot disease index (CRDI) ratings.

Treatments	Rate	CRDI
Ranman + ORO-79	20 fl oz+2 pt/a	20
Non-Treated	CHK	84
ORO-79	2 pt/a	34
ORO-79	4 pt/a	16
ORO-79	8 pt/a	23
ORO-09	4 pt/a	22
Mean		33
CV%		65
LSD (0.05)		22
P- Value (0.05)		0.00001*

* indicates significance at $P \leq 0.05$; “ns” is non-significant at $P \leq 0.05$

Results: Different rates of ORO-79, ORO-09 and Ranman + ORO-79 had similar effects in managing the clubroot under field conditions (Table 2) and the treatments were significant when compared with the non-treated check. The two-way interaction among main plots (lime and without lime) and sub plots (different treatments) did not have a significant effect at $p \leq 0.05$, indicating there was no added advantage on combination treatments of lime + surfactant to control clubroot.

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