Greenhouse Screening and Field Evaluation for Weed Tolerance in *Brassica oleraceae* Genotypes.

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INTRODUCTION

- Weed tolerance (WT) is the ability to produce at an optimal to high yield in the presence of weed populations (1).
- Weed tolerance has been documented in field crops and, to a lesser extent, vegetables (1,2,3,4).
- Cultivars of the same species can vary in their level of WT.
- Morpho-physiological markers associated with WT include (1,2):
  - Leaf area
  - Plant height
  - Time to maturity
  - Nutrient uptake

Figure 1. Broccoli cv. Packman grown under high weed density (HWD) Field planting 1 .

Figure 1. Broccoli cv. Gypsy grown under high weed density (HWD) Field planting 2.

OBJECTIVES

1) Screen seedlings of several *Brassica oleracea* genotypes for potential weed tolerance in the **Greenhouse** using physiological characteristics previously reported to be associated with weed tolerance.

2) Evaluate selected cultivars for weed tolerance under **Field** conditions.

MATERIALS AND METHODS

- Two **Greenhouse plantings**:
  - Experimental design -RCBD, 2 treatments (low and high nutrient), 4 replications with 12 sub-samples .
  - Dates:10/11/06 - 11/13/06 and 12/20/2006 - 01/21/2007.
  - Harvested 30d after emergence and evaluated: leaf area (cm^2), chlorophyll content, biomass production of fresh (fwt) and dry weight (dwt), number of true leaves, nitrogen concentration of aboveground biomass.

- Two **Field plantings**:
  - Experimental design - RCBD, 2 weed treatments (low (LWD) or high (HWD) weed densities), 3 replications with 3 sub-samples .
  - Dates:02/07/07-04/17/07 and 11/09/07-02/13/08.
  - Weed simulation: HWD plots were seeded with *Avena sativa* variety TAMO 405 (35 kg ha^{-1}) target rate of 20 plants/m^2.
  - Harvest data: inflorescence weight (IW), leaf and stem weight (LSW), leaf area (LA) and weed species composition and biomass. Weed tolerance was quantified using the formulae: 1) IW_{HWD}/IW_{LWD} or 2) LSW_{HWD}/ LSW_{LWD}.

RESULTS

Greenhouse plantings:

- Phenotypic traits varied among all genotypes: significant differences were observed among cultivars in leaf area (range: 30-115 cm^2), chlorophyll content (range: 30-51 SPAD units), dry matter production (35-410 mg per plant) and tissue nitrogen concentration (0.84-5.33%).
- Genotypes were selected by ranking phenotypic traits as possessing high, intermediate, and low WT potential. Ranking was used to select for Field plantings.

Field plantings:

- **FP1:** Significant difference in growth, yield, and ratio in weed tolerance.
- **FP2:** No significant differences for most traits, lack of ability to detect significance in due to high variability (CV=60-80%).
- Packman yield highest in Planting 1 and Gypsy was numerically highest in Planting 2 (Tables 1).
- Tissue nitrogen content in the Greenhouse plantings and Days to Harvest in the field were associated with weed tolerance (Figures 5 & 6).

Table 1. Total fresh weight (g) of inflorescences at harvest.

Date	Cultivar	LWD[x]	HWD[y]	Ratio[z]
Field Planting 1.	Arcadia	43.2 ± 5.5	44.6 ± 6.7	1.03
02-07 / 05-07	Barbados	114.6 ± 10.9	73.9 ± 10.5	0.64
	Flash	160.2 ± 13.3	135.1 ± 13.1	0.84
	Marathon	127.9 ± 12.7	35.1 ± 5.4	0.27
	Packman	241.3 ± 18.1	259.6 ± 14.3	1.08
	Waltham	153.8 ± 15.9	119.1 ± 16.5	0.77
Field Planting 2.	Arcadia	105.4 ± 37.5	*	0
11-07 / 02-08	Barbados	97.1 ± 18.9	*	0
	Flash	117.2 ± 28.9	*	0
	Gypsy	134.8 ± 26.5	33.4 ± 23.7	0.25
	Marathon	72.9 ± 20.8	*	0
	Packman	56.22 ± 12.1	5.0 ± 2.8	0.09
	Waltham	37.2 ± 11.9	*	0

[x]LWD = Low weed density treatment.
[y]HWD = High weed density treatment.
[z]Ratio = HWD yield / LWD yield.
* No harvest / inflorescence development.
Values are means ± standard errors.

Dominant Weeds

- **FP1:** HWD - *Avena sativa 89.0g/.25m²* mean density, representing *53%* of total biomass for HWD grass species and *Galinsoga parvifolia 41.4 g/.25m²* at *69%* of total biomass for HWD broad leaf species.

- **FP2:** HWD - *Panicum maximum 481.3g/.25m²* mean density, representing *96.6%* of total biomass for HWD grass species and *Macroptilium lathyroides 28.6 g/.25m²* at *31.2%* of total biomass for HWD broad leaf species.

Figure 3. Field Planting 1. 'Marathon' high weed pressure 31days after transplant.

Figure 4 A &B. Field Planting 2., Barbados 30 days after transplant. **4A.** LWD plot. **4B**. HWD plot with *panicum maximum* out competing the Brassica genotype.

DISCUSSION AND CONCLUSIONS

- Variability in WT was observed among broccoli genotypes.
- The data suggests that time to maturity and nitrogen uptake may serve as useful markers to screen cultivars for WT (Figures 5 & 6).
- Use of WT genotypes may allow growers to reduce cultivation and/or herbicde use without substantial decreases in yield.
- Employing WT cultivars may help reduce growers costs in weed management programs.
- Multiple factors appear to influence WT, and additional study is need on the genetic x environmental factors involved in the expression of WT.

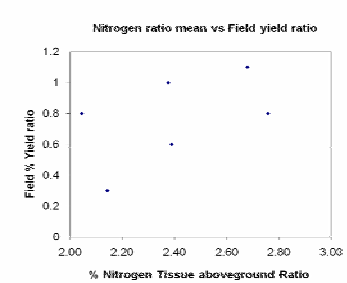

Figure 5. FP1. Nitrogen ratio mean vs. Field yield ratio.

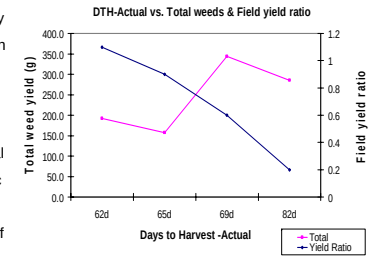

Figure 6. Days to harvest-actual vs. Total weeds and Field yield ratio.

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