Yellow mustard: An oilseed rotation crop for the Willamette Valley

Yellow mustard (*Sinapis alba* L.) is a new multi-purpose oilseed rotation crop for Willamette Valley agriculturalists. It is a distant relative of the *Brassica* species and is not a compatible cross with any specialty seed crops; therefore, yellow mustard is not included in the current Oregon legislative regulations of canola production. In addition to use as an oilseed crop, yellow mustard is also produced as condiment mustard, green manure, and as a bio-pesticide.

Currently, all North American industry production recommendations have developed from the University of Idaho, Canada, and the Midwest. The objectives of this study were to (1) determine the relationship of applied nitrogen fertilizer on seed yield and yield components of yellow mustard under Willamette Valley growing conditions, and (2) examine how incremental increases in applied N affect plant structure, lodging, and harvest index.

Experimental Methods:

The first of two field experiments with 'IdaGold' yellow mustard was planted on March 11, 2013. Nitrogen fertilizer treatments (0, 50, 100, 150, and 200 lbs N/acre) were applied on April 4 with plant growth, development, and lodging rates tracked weekly throughout the growing season. The following measurements were obtained:

1) Aboveground biomass & plant height – stem elongation (April 30), flowering (May 20), harvest
2) Leaf area – stem elongation, flowering,
3) Components of yield – harvest

Two weeks prior to harvest, plant samples were obtained to determine plant height, aboveground biomass, and components of seed yield. Components of yield measured include the number of branches per plant (main stem and primary and secondary branches), the number of pods per branch, and the total number of seeds per branch type. Plots were swathed on July 16 and combined on July 23, from which harvest index, clean-out, and total seed yield were calculated.

Results:

Applied N fertilizer treatments influenced measured yellow mustard characteristics at varying degrees of significance. Due to warm weather patterns experienced over the 2013 growing season, mustard plants grew at a greater rate than anticipated or previously observed. Lodging was only present in 150 and 200 lbs N/acre plots; however, the typical negative lodging effects of reduced pollination, increased harvest difficulty, and reduced yield were not observed.

Generally, plant height, aboveground biomass, and leaf area maintained a positive correlation with N fertilizer treatments. At stem elongation, treatments receiving N were taller than the control (Figure 1), and as the plants continued to grow, the greatest height was observed in the 150 and 200 lbs N/acre treatments. When measured at harvest, the average plant height was only about 7% greater than at flowering, indicating that yellow mustard reaches nearly full mature height during flowering.

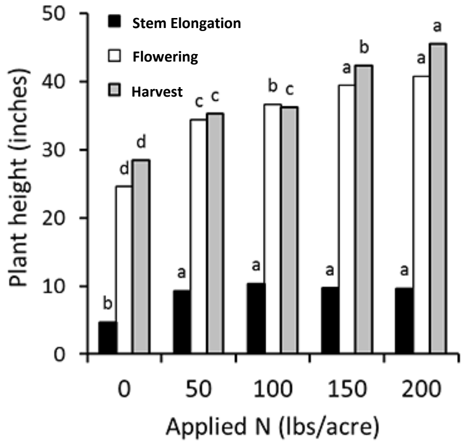

Figure 1. Effect of applied N fertilizer on yellow mustard plant height at the stem elongation and flowering growth stages and harvest. Means presented for each measurement date are not statistically significant (P = 0.05) if followed by the same letter.

Aboveground biomass measurements illustrated that plots not receiving applied N fertilizers (the control) consistently produced significantly less vigorous stands (Figure 2). As expected, applied N notably influenced yellow mustard leaf area, a measurement of plant photosynthetic capacity. Typically, increased applied N caused an increase in the average leaf area by 5.4% to 37.9%, with only the 100 lbs N/acre treatment experiencing a 2% decrease in leaf area.

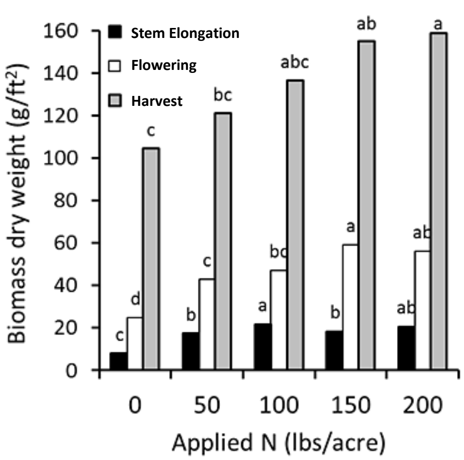

Figure 2. Effect of applied N fertilizer on yellow mustard aboveground biomass at stem elongation, flowering, and harvest. Means presented for each measurement date are not statistically significant (P = 0.05) if followed by the same letter.

Applied N had a substantial influence on all yield components. Plots receiving the highest rates of N fertilizer had significantly greater total branch count (primary and secondary branches) compared to the control plots as well as the 50 lbs N/acre treatment. With increased branch production, these plants also surpassed the control treatment in the number of main stem and primary pods as well as the number of seeds produced per stem (data not shown). Seeds produced on main stems from the 150 and 200 lbs N/acre rates attained the greatest mass; the 200 lbs N/acre rate far surpassed other rates in terms of primary seed mass, being 32% greater than the 150 lbs N/acre treatment and 177% greater than the control.

Table 1. Applied nitrogen effects on seed number, seed weight and seed yield.

Applied Nitrogen	**Seed Number**	**Seed Weight** †	**Seed Yield**
(lbs N/acre)	(Total # seeds/plant)	(mg)	(lbs/ac)
0	2,052.9 d	6.923 bc	1363 d
50	2,481.8 cd	6.825 c	1555 c
100	2,950.5 cb	6.835 bc	1575 bc
150	3,367.6 b	7.042 ab	1725 b
200	4,004.3 a	7.192 a	2295 a

† Seed weight (mg) calculated from thousand seed weight measurements. Means presented within each column are not statistically significant by Fischer's LSD (P=0.05) if followed by the same letter.

Considering the strong influence of applied N fertilizer on the components of yield, it is no surprise that N fertilizers also had a complex influence on seed yield (Table 1). The 200 lbs N/acre fertilizer rate produced the highest seed yield of 2,295 lbs/acre, resulting primarily from the overall quantity of seeds, whereas the control yielded 1,363 lbs/acre. In 2013, the general relationship between applied N fertilizer and yellow mustard seed yield was that yield increased with increases in rate of N fertilizer applied.