CHAPTER 2. Materials and Methods

Field experiments were established at each of three Virginia sites in both 1998 and 1999. In 1998, the locations included Middlesex, Amelia and Montgomery counties. In 1999, the locations included New Kent, Amelia and Montgomery counties. These locations were chosen to represent three unique soil types and three unique sets of growing conditions (Table 2.1. - 2.3.). Corn planting dates for full-season and double-crop plantings varied between locations as a function of climatic and edaphic conditions (Table 2.4.). Experiments were conducted in a split-plot, randomized complete block design with cropping system as the main plot and herbicide treatment as the subplot. Each location contained a traditional full-season no-till planting and a double-crop no-till planting. Each planting contained four blocks at each site, with twenty-one randomized herbicide treatments applied to each block. The content of each treatment did not change between plantings at each site; however, the timing of the treatments were different between the two plantings (Tables 2.5. - 2.7.). Herbicide rates and treatments varied between locations and years depending on soil type and weed infestation (Table 2.8.). Preemergence herbicide rates varied between locations to reflect atrazine and metolachlor rates for specific soil types and organic matter content. Postemergence herbicide treatment content varied between locations as determined by the specific weed infestation present. Postemergence herbicide content varied in only three treatments between locations. These postemergence treatments were included to evaluate weed control with selective herbicides compared to weed control with glyphosate in glyphosate resistant corn.

The full-season cropping system was simulated by killing the barley crop with 1.12 kg ai/hectare of glyphosate in early February. This allowed the barley residue to decompose and additional weeds to emerge by planting in spring. The blocks which contained barley were used for the double-crop system. At all locations in both years barley was fertilized and harvested for grain. Barley yields were determined as a field average in all locations.

Herbicide treatments included combinations of nonselective herbicides for no-till establishment and/or preemergence residual herbicides and/or selective postemergence herbicides in both production systems. Individual plots were 3.1 meters wide by 9.1 meters long containing four corn rows. The center 1.8 meters of each plot containing the two center corn rows were treated, leaving a 1.2 meter buffer area containing two corn rows between each treated plot. Herbicide treatments were applied using a CO_2 backpack sprayer at a volume of 210 l/ha with flat-fan spray tips[1]. All herbicide treatments with the exception of the control and the glyphosate treatments contained 0.5% V/V of a nonionic surfactant[2]. A glyphosate tolerant corn[3] hybrid, which also expressed insect protection as provided by the incorporation of the *Bacillus thuringesis* gene was planted both years at each location. Corn was planted with a population of 69,200 seeds per hectare in 76 cm rows using a two-row no-till planter[4] at all locations. The double-crop corn was planted directly into the barley stubble and straw subsequent to barley harvest. Both cropping systems were fertilized with 154 kg/ha of nitrogen when the corn was 8 to 10 cm tall.

[1] Teejet 8003 flat fan spray nozzles, Spraying Systems Co., North Ave. Wheaton, IL. 60188
[2] X-77, non-ionic surfactant, Valent USA Corp. 1333 N. California Blvd., Walnut Creek, CA. 94596
[3] Dekalb 591 Roundup Ready/Bt
[4] Almaco planter, 99 M Avenue, Nevada, Iowa 50201

Herbicide efficacy ratings by weed species were made throughout the growing season. The rating scale ranged from 0-100; 0 was equal to the weed population observed in the control plots and 100 was equal to compete weed death. Prior to corn harvest, weeds were harvested from a one square meter area of each plot. These samples were then separated by species and oven-dried to determine weed biomass. The two center corn rows of each plot were harvested by hand at maturity, and grain moisture and yields were determined for each plot. Weed control ratings, corn vigor, corn yields and weed biomass were subjected to analysis of variance and differences between the means were compared using Duncan's Multiple Range Test at the 5% level of significance. To determine significance of main and interaction effects for cropping system and herbicide treatment in the experiments, two-way factorial analysis was performed at the 5% significance level.