The Effects of Legumes as Living Mulches on Weed Control and Plant Traits of Corn (*Zea mays* L.)

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ABSTRACT In order to investigate the effects of interseeding leguminous species as living mulches on weed control and plant traits of corn, a field study was carried out at the Agricultural Research Farm, Razi University, Kermanshah, Iran. The experimental design was a randomized complete block with four replications. The treatments consisted of six leguminous species (Persian clover, *Trifolium resupinatum* L.; white clover, *T. repens* L.; berseem clover, *T. alexandrinum* L.; hairy vetch, *Vicia villosa* L.; alfalfa, *Medicago sativa* L. and black alfalfa, *M. lupulina* L.) and two controls (weeded and un-weeded for all of the growing season). The results indicated that the interseeded living mulches significantly improved the corn plant traits and reduced the weed dry weight produced as compared with full season weedy condition. All of the corn plant traits were substantially lower for full season weedy condition compared to the other treatments. This condition reduced corn yield 48.2% compared to weed free control. Among the interseeded treatments, the highest corn plant traits and the lowest weed dry weight were obtained from the plots interseeded with hairy vetch. Corn yield was increased 79% and weed dry weight was reduced 80.5% when the plots interseeded with hairy vetch as compared with full season weedy condition. Overall, this study confirmed the beneficial effect of the leguminous species as living mulches to efficient weed control and consequently the improvement of corn plant traits. This method would potentially reduce herbicide application and benefit a sustainable weed management program.

Key words: corn; interseeding; legume; living mulch; weed control.

INTRODUCTION

Corn (*Zea mays* L.) is a strategic crop in Iran that is used as a source of human and animal feed. Weeds are serious constraint to increased production in corn and reduce yield and economic returns. Weed competition can cause yield reductions of up to 70% in corn grain yields (Teasdale 1995). Corn producers in Iran are highly dependent on herbicide application and conventional cultivation as weed

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management tools. These practices can increase costs and soil erosion, pose a threat to the environment and may promote the development of herbicide resistance.

An alternative to herbicides and conventional cultivation is the use of living mulches between the crop rows. A system of this sort would potentially reduce herbicide application and the resulting environmental pollution and soil erosion. De Haan *et al.* (1993) reported that spring seeded living mulches can reduce weed density by up to 80% with little effect on corn yield. According to Palada *et al.* (1982) there was a 75% decrease in the number of weeds present when corn was interseeded with red clover or hairy vetch. Other legumes, such as subterranean clover have been reported to provide equal or better weed control than herbicide treatments in no-till corn without a decrease in corn yields (Enache and Ilnicki 1990; Ilnicki and Enache 1992). The effects of the living mulch are achieved by a rapid occupation of the open space between the rows of the main crop, which prevents germination of weed seeds and reduces the growth and development of weed seedlings. Germination of weed seeds may be inhibited by complete light interception (Phatak 1992) by the living mulch or by secretion of allelochemicals (White *et al.* 1989; Overland 1966). After establishment of weed seedlings, resource competition becomes the main weed suppressing mechanism of the living mulch (Teasdale 1998). Living mulches can suppress weed density by competing for light (Teasdale 1993) water and nutrients (Mayer and Hartwig 1986) and through the production of allelopathic compounds (White *et al.* 1989).

Living mulches may also be introduced in a main crop for a number of other reasons. Pest control (Theunissen and den Ouden 1982), the reduction of soil erosion (Wall *et al.* 1991) and the improvement of soil nutrient status through addition of organic nitrogen (Holderbaum *et al.* 1990; Brown *et al.* 1993) via fixed atmospheric nitrogen are important beneficial traits of living mulches. Intercropping legume living mulches can also increase the yield of the succeeding crop (Bollero and Bullock 1994; Decker *et al.* 1994). However, intercrops of corn and living mulches have not always resulted in a positive gain (Nordquist and Wicks 1974; De Haan *et al.* 1997). Moreover, living mulches differ in their ability to establish well in an interseeding situation. For example, Exner and Cruse (1993) found that alfalfa and sweet clover usually established better and produced more cover than either red or alsike clover when interseeded under corn. The competitive ability against weeds is also another important characteristic determining the suitability of a plant species as a living mulch. Consequently, the success of these kinds of cropping system is largely determined by the selection of the most appropriate living mulch species.

Therefore, this study was conducted to evaluate the effects of six species of leguminous living mulches on weed control and plant traits of corn and subsequently the selection of the most appropriate living mulch species for an interseeding system.

MATERIALS AND METHODS

The experiment was carried out in 2006 at the Agricultural Research Farm of Razi University, Kermanshah, west Iran. The soil type was a silty clay with a pH of 7.9-8.3 and 0.8% organic matter. The land was plowed and cultivated before planting. Fertilizers were applied according to the soil test recommendation. The corn cultivar used was 'KSC 704' (a grain corn cultivar that is commonly planted in the region). In order to protect against soil-borne diseases, prior to seeding, the corn seeds were treated with benomyl at 0.2% (w/w). The crop was