Establishment of Kura Clover

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Abstract

This research was designed to test for factors which could speed the establishment of kura clover (*Trifolium ambiguum)*, a difficult-to-establish forage legume. Building upon past research at Wilmington College, treatments included soil incorporation of active biological additives/extracts, liquid fertilizer, activated charcoal, and a control. Measurements were taken on days to emergence; number emerged; days to 1st, 2nd, and 3rd trifoliate leaf development; daily average plant height; greenhouse temperature; outside weather (clouds/sun); and plant dry weight. Results indicate that the presence of certain live biological components in the soil have a significant impact on establishment speed.

Introduction

Kura clover is an excellent-quality, cool-season forage legume, comparable in many ways to alfalfa (*Medicago sativa*). It is native to the Caucasus region of Eurasia, and was introduced into the United States in 1911. It is difficult to establish, but is renowned for its outstanding winter hardiness, drought tolerance, forage quality, and persistence under grazing. Further, kura clover is being explored for both its potential as a living mulch beneath conventional grain crops, and for its suitability as a long-lived ground cover in bare-soil mine spoils within the United States. It has a higher leaf-to-stem ratio than alfalfa; therefore both its crude protein (~18-25%) and digestibility levels are slightly higher than alfalfa's. Once established, kura clover thrives under a wider fertility and pH range than does alfalfa. Under grazing, its persistence remains at nearly 100%, comparable to the superb grazing tolerance of white clover (*Trifolium repens*) forage. Kura clover often requires no re-seeding for 20 or more years due to its extensive rhizomatous rooting system. Because of these traits, kura clover could conceivably replace alfalfa as the most economical livestock feedstuff if methods to speed field establishment are developed.

Under most field conditions, kura clover establishment is costly and labor-intensive. In kura clover's first two years of growth, poor seedling vigor makes it a notoriously poor competitor with weeds and established forages. Competition must therefore be heavily suppressed using chemical or mechanical controls. Percent germination rates of commercial treated seed in normal field conditions fall within acceptable limits, but little scientific research has been performed to reveal why kura clover's early post-germination growth is so poor. Supplemental nitrogen applications have not been shown to consistently speed kura establishment or otherwise assist *Rhizobium* nodulation.

Past research by Tom Smith and WC student Matt Stroud indicates that certain soil amendments significantly (P<0.05) speed kura clover establishment. An unidentified organic fraction of the soil had the highest statistical impact on establishment. If better cultural methods for raising kura clover could be discovered and disseminated, farmers across much of the temperate central and northern U.S. could significantly lower livestock production costs.

Materials and Methods

Soil Treatments:

. 1) Control Soil
. 2) Soil + *Trichoderma* drench
. 3) Soil + Activated Charcoal (incorporated)
. 4) Soil + *Rhizobium* inoculation
. 5) Soil + Endo/ecto *Mycorrhizae*
. 6) Soil + 10-34-0 liquid fertilizer
. 7) Soil + Humic acid extract

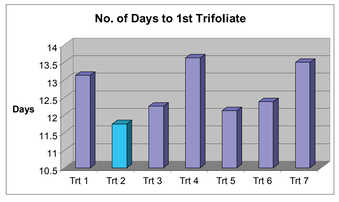
Data Recorded:

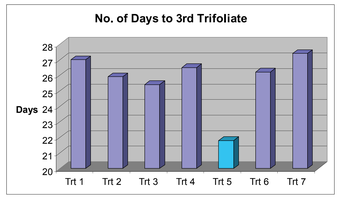
Days to emergence; number of plants emerged; days to first, second, and third trifoliate leaf development; daily plant height; daily greenhouse high/low temperature; outside weather (clouds/sun); and plot dry weights.

Experimental Design:

Randomized Complete Block, with a split-plot design and 5 replications. Seven subplots and two main plots (commercial potting soil/soil from established kura clover plot). 2 split-plots x 7 treatments x 5 replications = 70 pots. The split-plot experimental design was used to test for the effect of any unknown biological agent present in a pre-established kura clover pasture using growing media taken from an in-county stand of kura clover.

Data





Results

Data was analyzed using MSTAT. Analysis of Variance (ANOVA) was used to interpret the results. Significance was assumed at ($P < 0.05$).

Live *Trichoderma* drench shortened the average length of time to 1st-trifoliate leaf development (P=0.0307), and soil-incorporated endo/ecto-*Mycorrhizae* culture shortened the length of time to 3rd-trifoliate leaf development (P=0.0131). The potting soil main plot encouraged higher emergence rates after 6 days (P=0.0333), after 24 days (P=0.0184), lowered the average number of days until emergence (P=0.0348), and increased average plant height after 40 days (P=0.0470).

The research found that certain biological treatments (specifically, *endo/ecto Mycorrhizae* and *Trichoderma* drenches) have a significant effect on speed of growth at the levels used. The data suggested that the differences between treatments began to become more distinct near the end of the trial period, but further research would be needed to determine if this trend continues and becomes statistically significant ($p < 0.05$).

Discussion

Although still statistically insignificant (P>0.05) after 42 days of observations, the significance between treatments appeared to be increasing the longer the trial went. Therefore, if further research were continued for longer than 42 days, more differences could possibly be found between treatments. Replication 5 seemed to have irregular growth, but when the data was analyzed without that replication, no changes in significance were found. The irregularity of the 5th replication could have been caused by some slight alfalfa contamination that was not discernible until 20 days into the experiment.

Conclusion

Prior research at Wilmington College indicated some slight differences in kura clover vigor and establishment between organic soil amendments. This research finds that certain live biological agents positively affect kura clover establishment. Specifically, this research finds that commercial-grade *Trichoderma* drench and a consumer-grade incorporated endo/ecto-mycorrhizal mix have significant positive effects on seedling vigor and speed of establishment when measured by time to first and third trifoliate leaf development. The potting soil main plot treatment encouraged statistically higher emergence rates, higher average plant height at 33 and 40 days, and increased speed of emergence versus the soil obtained from an established kura clover plot. The differences in clover performance in each soil is probably due to the higher clay content and thus poorer drainage of the latter soil. Further research is recommended to determine if higher treatment rates or other biological treatments would have any effect on kura clover establishment.

Literature Review

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