



Sainfoin Seeding Trials 2012 – 2014

Suitability of Sainfoin (*Onobrychis viciifolia*) as a Rangeland Forage Crop in California

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ABSTRACT

Landowners in the Sacramento Valley had requested a seeding trial of Sainfoin (Onobrychis viciifolia) to determine the long-term survival of three different cultivars (Eski, Remont and Shoshone) in Major Land Resource Area 17 (Sacramento and San Joaquin Valleys). Sainfoin is currently used as a non-bloat hay/pasture and rangeland forage species to increase the protein content of the sward. The objective of this project was to study the persistence of Sainfoin and its ability to survive California's hot summer conditions. To provide seeding and cultivar recommendations to be accessed by the eVegGuide, and include management practices to maintain its persistence. Seeds were planted in plots that were clean cultivated in the fall of 2012. Plantings were direct seeded using a Truax range drill. Seeding rates were 34 lbs/acre for all three Sainfoin cultivars, 8 lbs/acre for Orchardgrass/Sainfoin plots and 10 lbs/ac for Purple Needlegrass/Sainfoin plots. Seed was planted at 1/4 inch. There was a 10' break between Sainfoin treatments which were seeded in the plots in a north/south direction, and replicated three times in an irrigated and non-irrigated split plot design. Grass seed was planted in an east/west direction as was alfalfa, which was used as a control plot. Three years of data collection showed that all three varieties of Sainfoin survivorship was poor in MLRA 17. Irrigated plots showed better survivorship than non-irrigated plots, but after three years few plants were seen in the area. With severe drought conditions in California, irrigation water was discontinued the second year into the study.

INTRODUCTION

Sainfoin was introduced from Eurasia in the late 1700's but was only occasionally cultivated until the 1960s (Roseburg, 1993, USDA-NRCS 2008). It is used frequently in the upper mid-west, and the northeast part of the United States in areas receiving more than 12 inches of annual precipitation. Sainfoin (*Onobrychis viciifolia*) has been used in the upper mid-west and high elevation rangelands of the west as a non-bloat forage source. The plants maintain their forage quality even after senescence (Roseburg, 1993)..

Three varieties used in the seeding trails; Remont, Eski and Shoshone. Remont and Eski were released by Montana Agricultural Experiment Station in 1971 and Montana State University in 1964. Shoshone

was released by University of Wyoming in 2006. The NRCS Plants Database shows it suitable for California, but little data is available on the success of this plant in the state and none for the Sacramento/San Joaquin Valley region (MLRA 17). It is a non-bloat forage with protein content similar to alfalfa (19–21%). Sainfoin nutritive value does not decline with maturity to the degree that alfalfa does (Lauriault, 2009). It yields similar to alfalfa, is drought resistant and the seed costs make it economically feasible for most landowners (\$1.50-\$2.00/lb) (Violett & Killen, 2010). Although the Plants Database shows that it is suitable throughout California, no literature could be found to support this. Ranchers in California have asked about its ability to be used in range seedings or as a forage in pasture mixes due to its ability to provide additional protein with a low water use requirement (Peel et al., 2004). This is especially important during the ongoing drought. This lack of knowledge of the species in California led to this seeding trial.

The goal of this PMC field planting was to determine its persistence and survivorship in the California Mediterranean climate. The field trials fit into the mission of the Plant Materials Center by increasing the knowledge base of materials suitable for seeding in regions of California served by the Lockeford PMC.

MATERIALS AND METHODS

Sainfoin seed (Eski) was obtained from D and D Seed in Klamath Falls Oregon, and Remont and Shoshone varieties were obtained from Bighorn Sainfoin Seed Company, Clark, Wyoming. Seed was delivered in 2010 and stored in a cool dry seed storage container.

The soil type for the planting is a Vina fine sandy loam. The area was clean cultivated in the fall of 2012 prior to planting on November 6 & 7. Plantings were direct seeded using a Truax range drill, seeded at a depth of ¼ inch. Seeding rates were 34 lbs/acre for all Sainfoin plots, 8 lbs/acre for Orchardgrass and 10 lbs/ac for Purple Needlegrass/Sainfoin plots. Rainfall after planting in 2012 was 1.5” in November and 3.1” in December and plant establishment was good.

Weeds were controlled by cultivation in the unplanted areas. There was no other weed control apart from mowing. The most prolific weed was cheeseweed *Malva* spp. which had germinated in abundance during the wet fall of 2012.

Irrigation was applied via wheel-line starting to the irrigated block only starting on May 22, 2013 and 7” inches was applied over the summer.

Data was also collected on seedling germination rates, total biomass production, in the spring at peak growth and species composition over time. Data will be collected again mid-summer on regrowth post-harvest and again in the late fall to determine over summer survival rates.

The layout of the study is shown in Figure 1. Sainfoin plots were 10’x100’ with three replications for each variety, one set under irrigation and one set non-irrigated. The three treatments included Sainfoin alone, Sainfoin with Berber Orchardgrass and Sainfoin with Purple Needlegrass. ‘Mesa’ Alfalfa, a dryland variety was used as a control. Sainfoin was seeded in the plots in a north/south direction while grass seed was planted in an east/west direction.

Figure 1. Plot Layout for Sainfoin Trial.



RESULTS AND DISCUSSION

Sainfoin was planted in early November 2012, with rainfall amounts of 1.5” in November and 3.1” in December. Germination success was high with the Sainfoin germinating first followed by the Orchardgrass then the Nassella. In 2013 precipitation amounts dropped off with only 4.14 inches falling from January to June. The totals for the period of Nov-June was 8.11 inches when the average for this time should have been 19 inches.



Sainfoin germination – December 2012



Orchardgrass germination (planted east-west) with Sainfoin strips – January 2013

Precipitation totals for the 2012/2013 year was 8.9 inches when average precipitation for this area is 19 inches. Despite the low rain, plants grew well the first spring and summer (2013). In May, plants were clipped at peak growth. Plot sizes were .96 ft², measured in grams and multiplied by 100 to obtain pounds per acre of production. Clipped plots were oven dried and weighed.



Spring 2013 – Assessed during peak standing crop – Production values - .96 sq. ft. plots clipped in Sainfoin, Sainfoin/Orchardgrass and Sainfoin/Purple needlegrass fields.

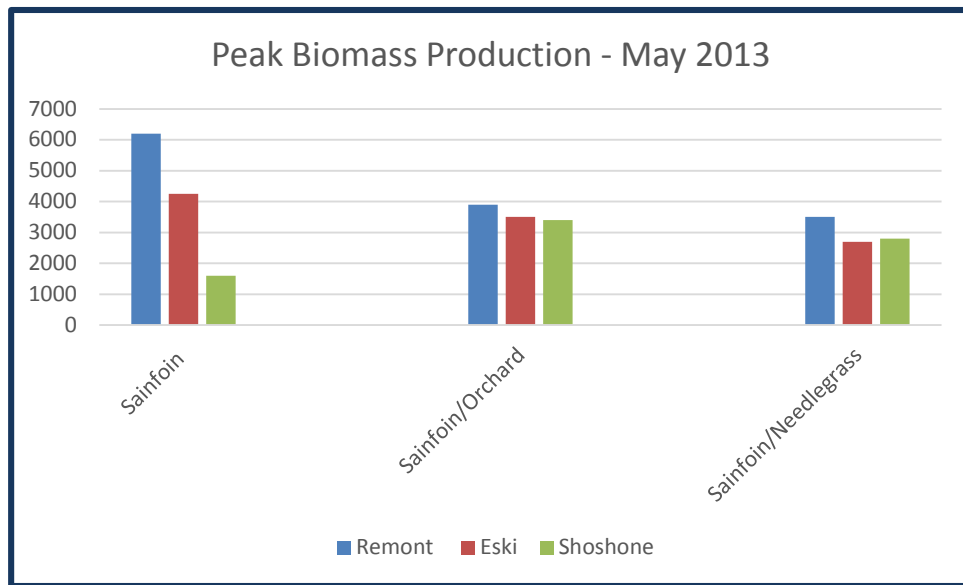


Figure 2 – Peak Biomass Production (lb dm/acre) 6 months post-seeding

This graph shows that Sainfoin produced better without the competition from the grasses, and ‘Remont’ out performed ‘Eski’ or ‘Shoshone’. Over time the grass plots dominated the Sainfoin and little remained after two years.



Sainfoin/Nasella plots – April 2014

This photo showed the response of purple needlegrass (*Nassella pulchra*) to Sainfoin. In the Sainfoin plots the Nassella was less robust than outside of the plots where Nassella alone occurred. Height differences in the plots were up to 6 inches higher. This probably reflected competition for moisture.



Control plots were 'Mesa' alfalfa a dryland cultivar. This photo is during the summer of 2013. Hay was cut off this field and approximate tonnage was 2 tons per acre.

The following graphs shows species composition of irrigated vs non-irrigated plots of the three different cultivars. Percentages shown are the amount of Sainfoin the balance of the plots were made up of invasive weedy species that moved into the sites on the "Sainfoin only" plots. Those weeds included annual grasses as well as forbs such as *Malva* spp., prickly lettuce (*Lactuca serriola*), filaree (*Erodium* spp.), mares-tail (*Conyza* spp.) and others.

The plots made up of seeded grasses and Sainfoin show only the percent of Sainfoin in the irrigated vs dryland plots. The other species that made up the additional percentages to equal 100 were primarily the seeded grasses. In both the purple needlegrass and Orchardgrass plots, the grasses outcompeted the Sainfoin in the dryland plots. In the irrigated plots, Sainfoin held high percentages of the species present through 2014.

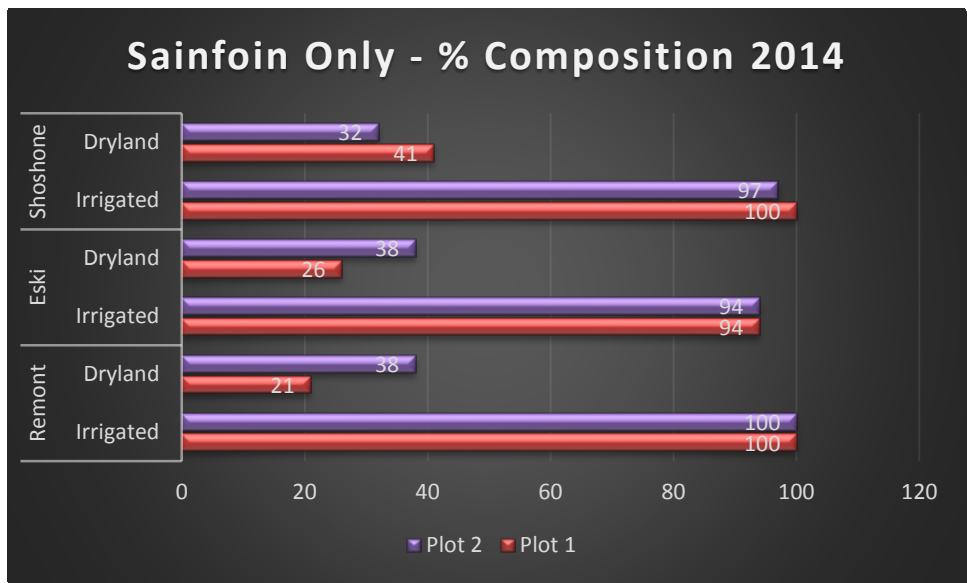


Figure 3 – Dryland vs. Irrigated % species composition along 100’ transect 18 months post-seeding, June 2014

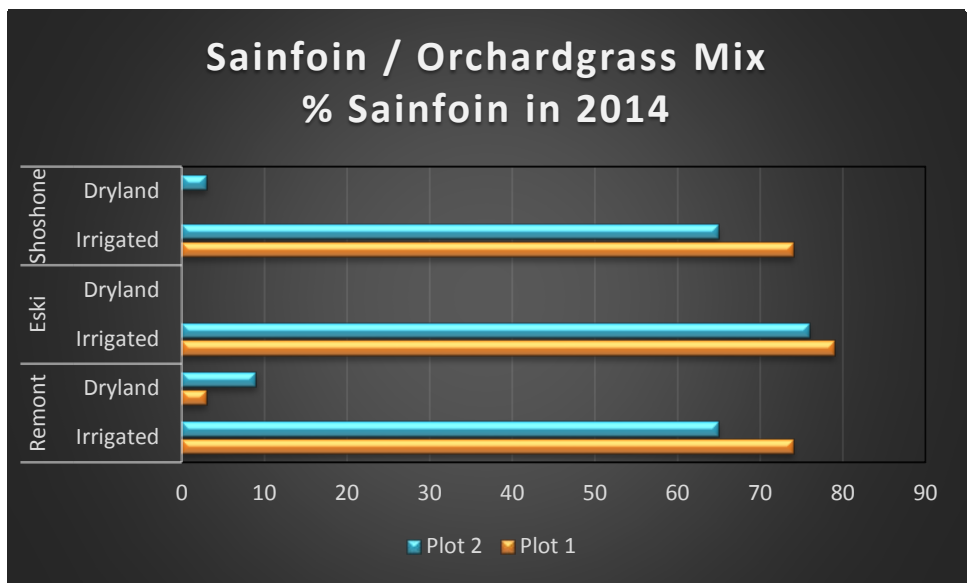


Figure 4 – Dryland vs. Irrigated % species composition along 100’ transect 18 months post-seeding, June 2014

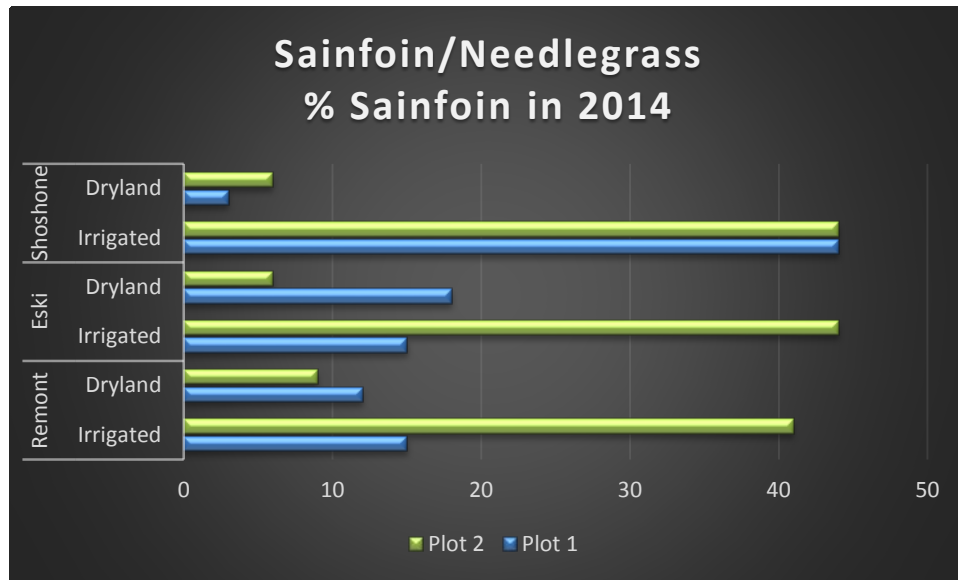


Figure 5 – Dryland vs Irrigated - % Species composition 18 months post-seeding, June 2014

Initial germination rates were well over 80% with the early November seeding followed by frequent fall and winter rains. By late spring Sainfoin growth averaged 18 inches with high production as shown in Figure 1. Some weedy species were present and those were removed from the clipped plots so data only shows the production of the Sainfoin, the Sainfoin/orchard grass and the Sainfoin/purple needlegrass plots. After full flower all plots were mowed to 6 inches to emulate grazing. Irrigated plots were watered every two – three weeks, while dryland fields were never irrigated. Summer temperatures exceeded 100 degrees for 5 consecutive days that summer. All irrigation was shut off by September. The winter of 2013/2014 was one of the driest on record. Little to no moisture fell on the plots until February 8, 2014. Then several good storms brought moisture to the plots. Precipitation totals for this year were 13 inches, 6 inches below the normal precipitation level of 19 inches for this site.

Spring/summer monitoring during 2014 showed that survival rates were very poor on the dryland plots, but good on the irrigated plots. Dryland plots averaged only 14.7% Sainfoin species composition with irrigated plots averaging 67.8% species composition. Dryland plots seeded to only Sainfoin were 32.6% Sainfoin while the grass/Sainfoin plots were 5.75% Sainfoin. Competition from grasses played a big role in the lower numbers in the dryland plots, as well as getting no additional moisture during the growing season.

Irrigated plots had better results with the species composition being 67.8% in late June 2014. The Sainfoin only plots averaged 97.5% while the grass/Sainfoin plots averaged 52.9% with the poorest success with the purple needlegrass at 33.8% and the Orchardgrass/Sainfoin averaged 72.1%. These plots were monitored in June and as July hit with 9 days over 100 degrees the plants in the dryland plots were reduced to only a few scattered plants. During this summer with continued severe drought in California the decision was made to suspend irrigation. Irrigation water was from an agricultural well and with water tables dropping in the central valley of California, it was determined that this was not a critical irrigation need. Plots were inspected in the spring of 2015 when only 13.4 inches of rain had

fallen during the 2014/15 rainfall period. This was 6” below the average. Since the irrigation had been curtailed the previous summer, the irrigated plots took on the growth characteristics of the dryland plots. With lack of water and hot temperatures, most plants died in the original irrigated plots. Only a few scattered plants were visible on all the plots within the entire seeded area.

Results showed that Sainfoin is not suitable for use as a forage plant in areas that receive no summer moisture and temperatures that can exceed 100 degrees for extended periods of time. Although most literature says it can be seeded in locations that exceed 14 inches of annual precipitation. The NRCS Plants Database shows it suitable for all of California. The study and the Plant Materials Center shows that under dryland conditions in hot areas of the state that do exceed the temperature requirement, Sainfoin will not persist. Due to the fact that our irrigation water was curtailed full results could not be obtained on its persistence under summer irrigation. Data after the first and second year, up to the time that irrigation was curtailed leaned toward plant numbers dropping off over time.

All three cultivars; Eski, Remont and Shoshone showed similar results in both the dryland and irrigated plots. With fewer numbers over time. Results indicate that summer heat and lack of water were the factors for the drop in species composition and plant vigor. Weedy species and amounts were similar to what would be found in a rangeland situation throughout the state, so competition from these species is expected in a rangeland seeding.

CONCLUSION

The conclusion of this field planting indicates that Sainfoin has very low survivability without irrigation and in sites that receive numerous days that exceed 100 degrees. This may include MLRA 17, 14, 15, 16, and 18. MLRA’s at higher elevation with over 14” of annual precipitation and cooler summer temperatures may be better suited to this species as a range seeding. Sainfoin can also be recommended as a legume for irrigated pastures in MLRA 21, 22, 23 and coastal areas of MLRA 4 & 5. Decisions on its suitability in southern areas of the state including MLRA 19, 20, 29 & 30 would require another seeding trail from the Plant Materials Center in Tucson Arizona that covers the southern part of California. A Technical Note will be developed to include this information and the eVegGuide will be updated to show the locations that are suitable for Sainfoin with associated seeding rates, planting depth and cultivar choices.

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