The Proportion of Bell Bean (*Vicia faba*) Biomass and Nitrogen in Cover Crop Mixes in Annual Crops and Orchards in Northern California

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Introduction

Cover crops are gaining popularity and momentum across the United States. California farmers are beginning to adopt cover crops and apply them to a variety of cropping systems statewide. Bell Bean (*Vicia* faba) plays an important roll in cover crop mixtures, due to its extraordinary ability to contribute biologically fixed nitrogen as well as biomass to the soil.

Objective: In this research, the proportion of bell bean within a biomass, nitrogen, and biological nitrogen fixation was quantified.

Hypothesis: The proportion of bell bean in cover crop seed mixes reflects the proportion of biomass and nitrogen.

Materials and Methods

Three fields were sampled: 1) “Vegetables” - a field that is used to grow leafy vegetables, 2) “Almond Orchard” - a conventional production almond orchard, where the cover crop was grown between the tree rows, and 3) “Flax” - a field which previously was under conventional almond production and is now regenerative fiber flax.

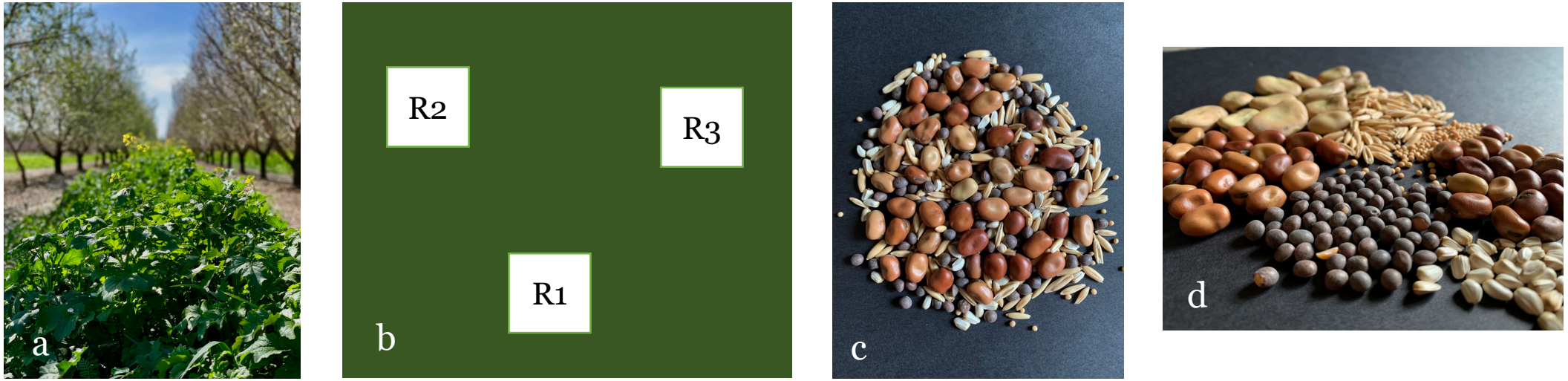

Figure 1: a) Almond Orchard cover crop, b)Representation of sampling method, c/d) cover crop seed mix example and components

Materials and Methods (cont.)

- A quadrat with an inner area of 30.48 cm^2 was used to isolate different areas of each field. The quadrat was randomly thrown into each sampling location three times. Once an area was isolated with the quadrat, it was pushed to the ground. All plant material within the quadrat was cut at the base and sorted into legume species, grass species, and fava bean.
- "Vegetables" and "Flax" were sampled twice, once after flowering began and once prior to termination. Location 2 was sampled one time prior to termination.
- The separated biomass was dried, weighed ($g/30.48cm^2$), ground, and a subsample was crushed in a BeadBeater. A 3mg ($\pm$ 10%) subsample was analyzed in a mass spectrometer for total nitrogen, $\delta^{15}N$, total carbon, and $\delta^{13}C$. Additionally, all biomass was compared by weight against planting seed ratios.

Results: Seed Weight Distribution

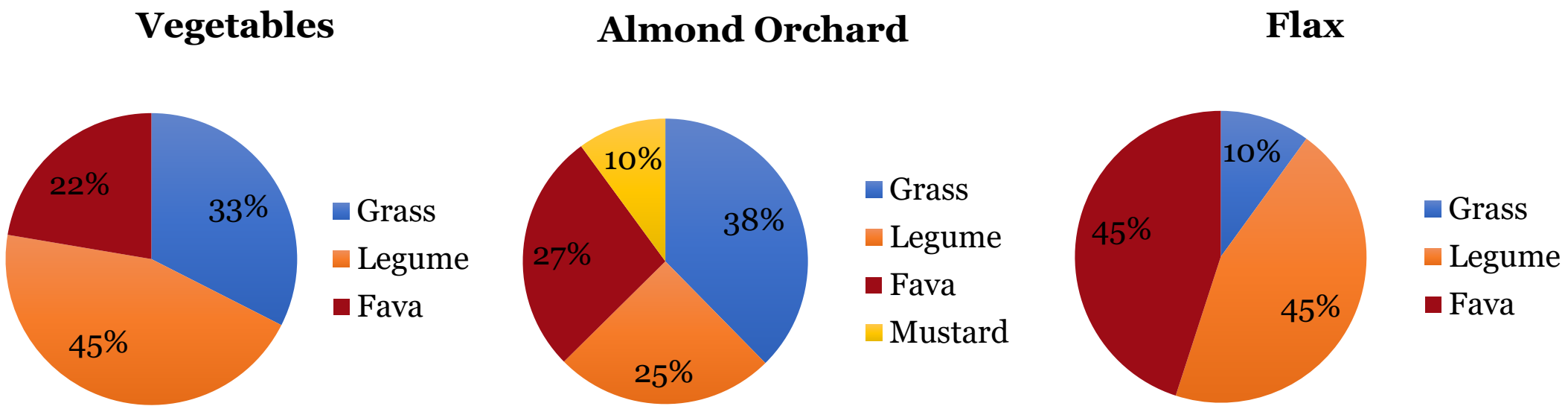

Figure 2: Percentage distribution of mixed seed types in 22.8kg bag at planting between the three sampled locations

Results: Biomass Distribution

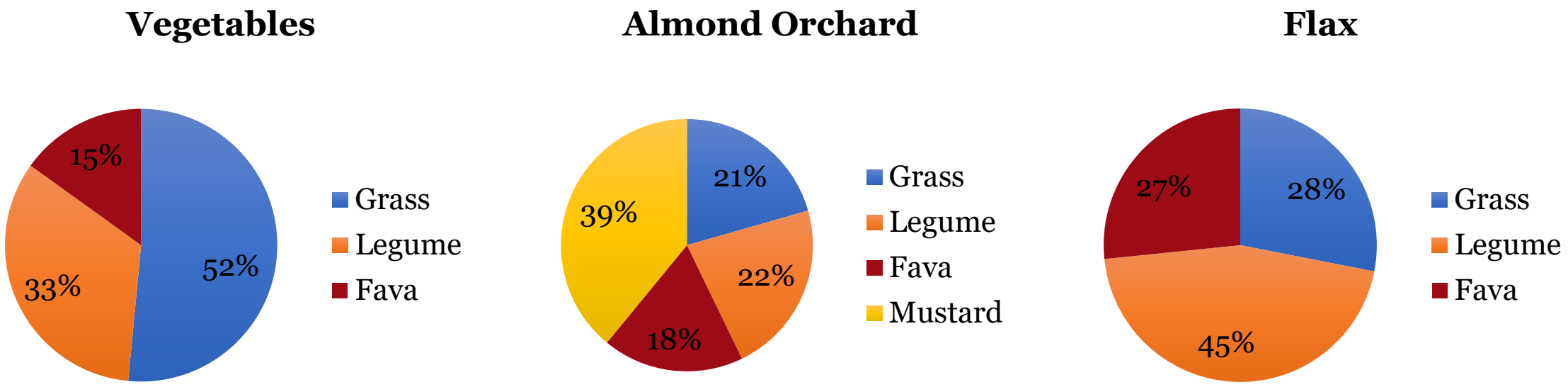

Figure 3: Percentage distribution of biomass as sampled between the 3 locations in g/30.48 cm^2

Results: Total N by species

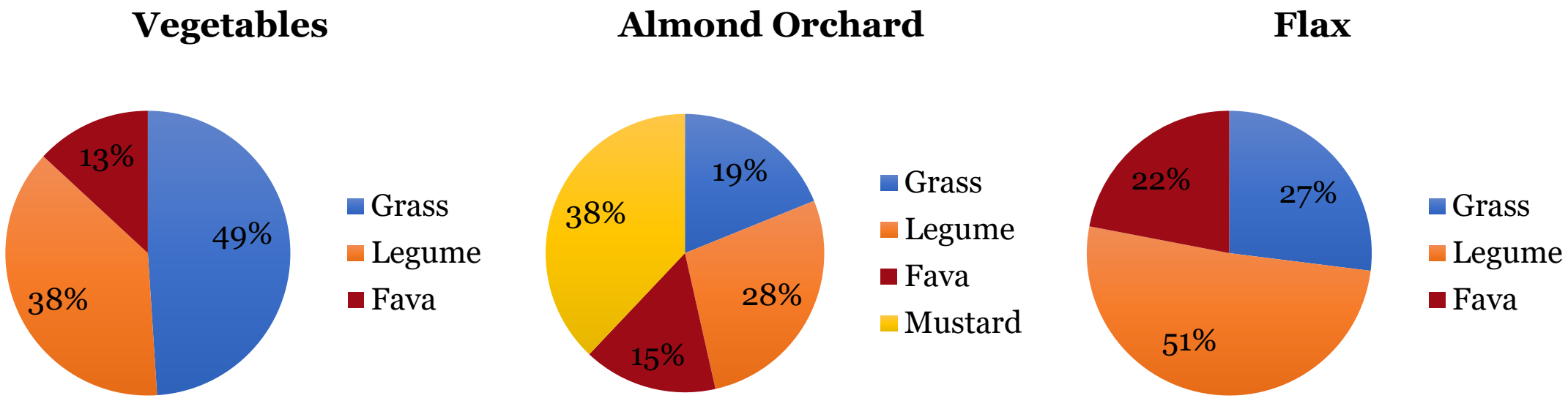

Figure 4: Percentage distribution of total N by species between the 3 locations sampled.

Results: NDFA and N Contribution

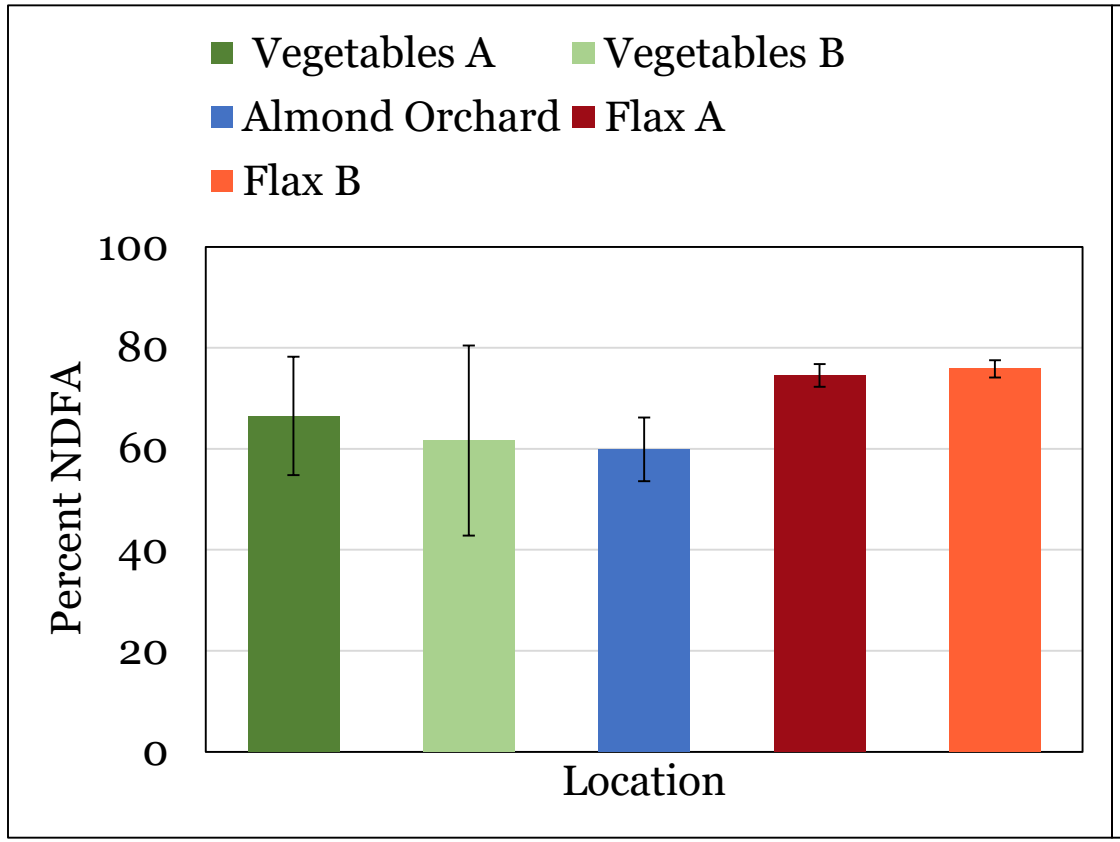

Figure 5: Comparison of average percent NDFA (Nitrogen Derived From the Atmosphere) across all samplings from bell bean

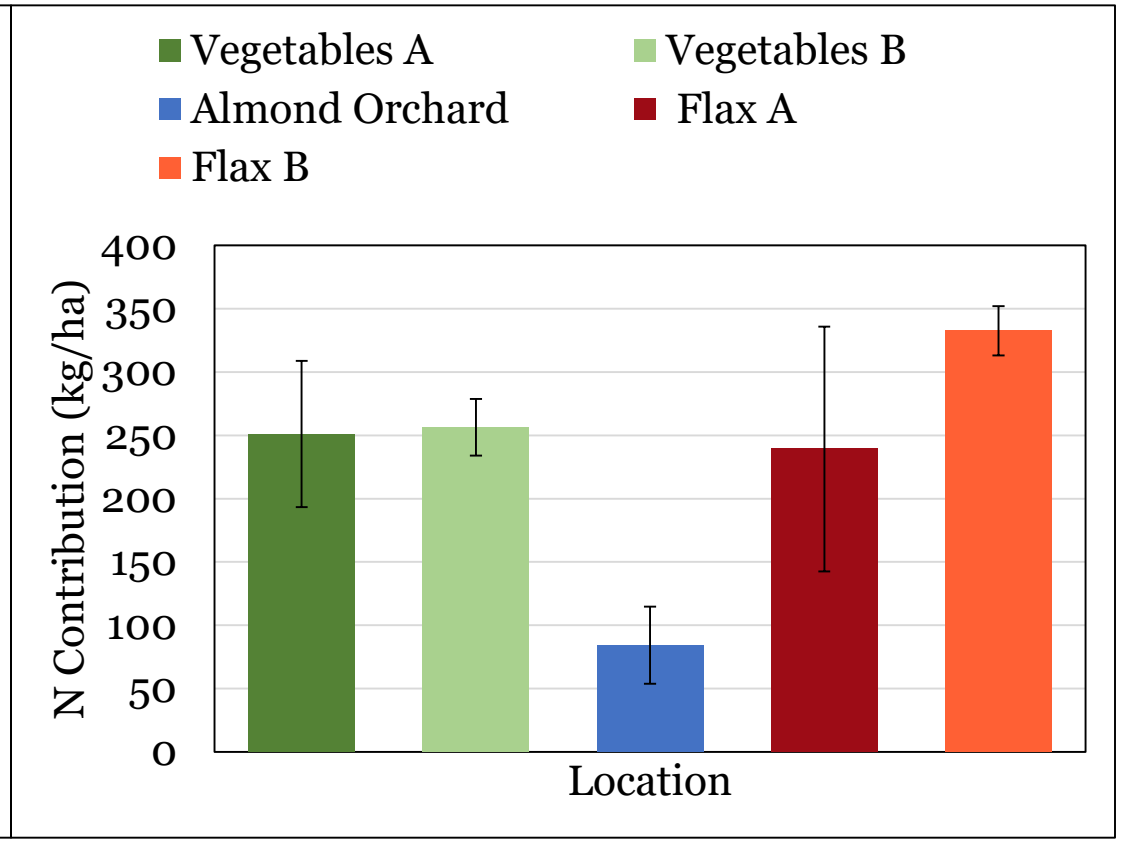

Figure 6: Comparison of average N contribution (kg/ha)across all samplings from total cover crop mix

Discussion

- CSUC Almonds lacked in percent bell bean by seed weight in the initial mix. This reflected a reduced percentage of NDFA, as well as greatly reduced total N contribution.
- Flax showed the greatest amount of bell bean by seed weight. This reflected the greatest amount of biomass, N by species, percent of NDFA, and total N contribution associated with bell bean across all surveyed sites.
- Despite having the least bell bean by weight, CSUC contributed a similar percent of NDFA as Flax.
- The cover crop mix as a whole at Flax contributed approximately triple the nitrogen as at CSUC Almonds.
- NDFA contributed by bell bean at Chico Flax showed the least number of inconsistencies, in addition to the highest overall percent.

Future Work

- Research will be replicated for a second year with additional locations.
- Soil will be sampled and analyzed for a more complete nitrogen analysis.

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