Legume Selection in the Tropics

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Introduction

By integrating legumes into cropping systems, small-scale farmers in low-resource settings can invest in the long-term health and resilience of their soils. Success or failure depends largely on choosing the right legume(s). Selection or screening trials are useful experiments that direct appropriate legume selection in context of local conditions

Benefits of legumes:

- Contribute to soil fertility
  - ✓ Accumulate nitrogen through symbiotic relationships with soil bacteria
  - ✓ Root systems draw nutrients from the soil
- Thrive in poor soils
- Add organic matter to agricultural systems
- Many produce an edible and/or marketable pulse crop

Purpose

Improve our understanding of how climate influences legume growth, in turn, enhancing our ability to respond to legume selection inquiries. Work was done in partnership with individuals/organizations serving small-scale farmers.

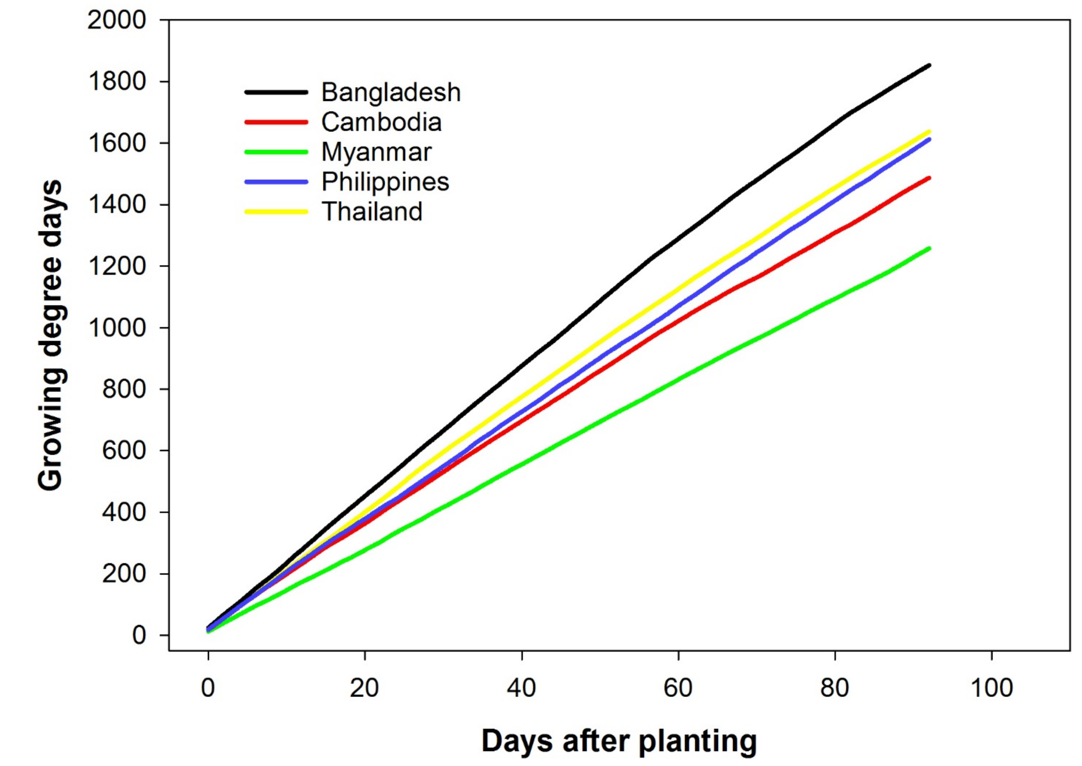
Trial Design

Cowpea *(Vigna unguiculata),* jack bean *(Canavalia ensiformis*), lablab *(Lablab purpureus),* and rice bean (*Vigna umbellata)* were trialed in each of five countries in Southeast Asia. Seeds were direct-sown into 2 X 2 meter rain fed plots with no fertility inputs. Seeds were planted at a 50 X 50 cm spacing. Data loggers were buried at a depth of 10 cm to monitor soil temperatures. Rainfall and air temperature data were collected from online weather services. Above ground biomass was cut and weighed from half of each plot when the plants began forming pods. A sub-sample (200 grams) of fresh, green material was dried and weighed, with the sub-sample dry weight used to calculate dry matter in terms of metric tonnes per hectare (t/ha).

Results and Discussion

Growing Degree Days (GDD):

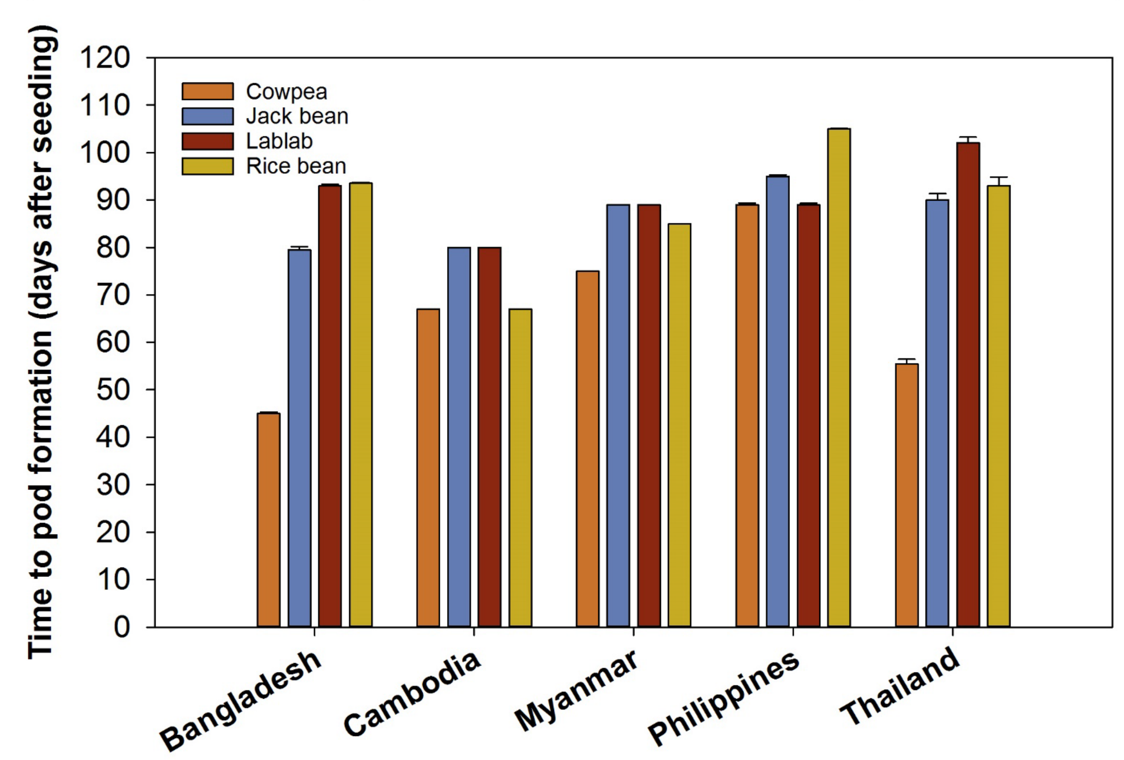
GDD results show that the site in Bangladesh accumulated GDD the fastest, with the Myanmar site accumulating the fewest GDD.



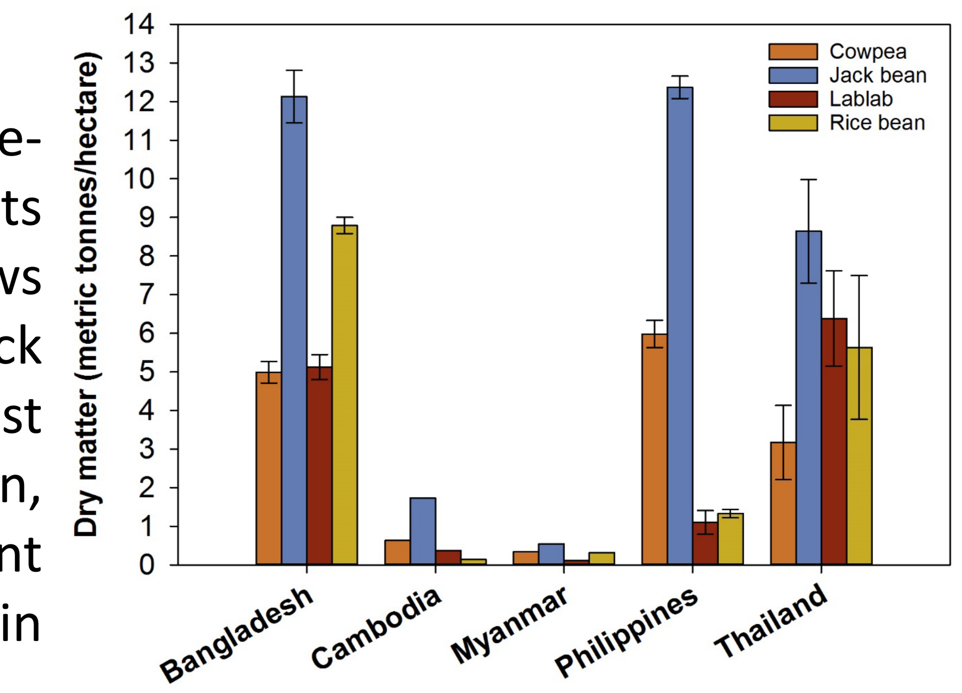
GDD were based on soil temperatures for all countries except the Philippines; air temperatures were used for the Philippines because soil temperature data for that site were lost.

Pod Formation:

Number of days to pod formation indicates that overall, cowpea matured faster than the other legumes. Cowpea matured soonest (about 45 days after sowing) at the Bangladesh site, a finding consistent with the fact that GDD accumulated the fastest in Bangladesh. Statistically, cowpea harvest time was strongly and inversely correlated (Pearson correlation coefficient [PCC] > -0.93; P <0.0001) with GDD, meaning that cowpea maturation time decreased with increasing GDD. Early-maturing cowpea could be a good choice for areas with short rainy seasons that accumulate heat units (GDD) quickly. Early-season ground coverage is another benefit of a fast-growing legume. Jack bean, lablab, and rice bean took closer to three months to begin producing pods. Longer-term legumes provide late-season ground coverage and food/fodder options; they are good options for increasing dry-season productivity, if the preceding rainy season is long enough for them to become established.

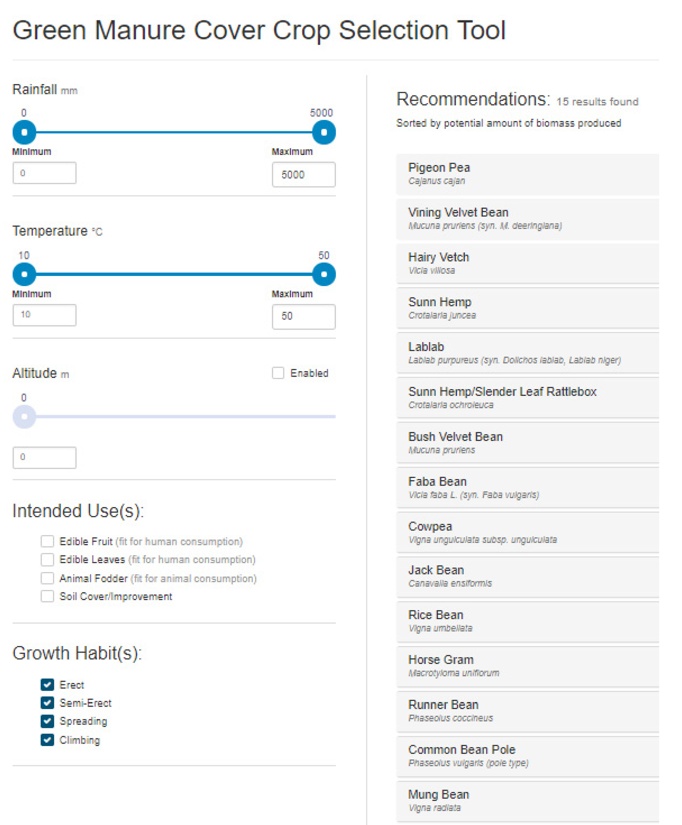


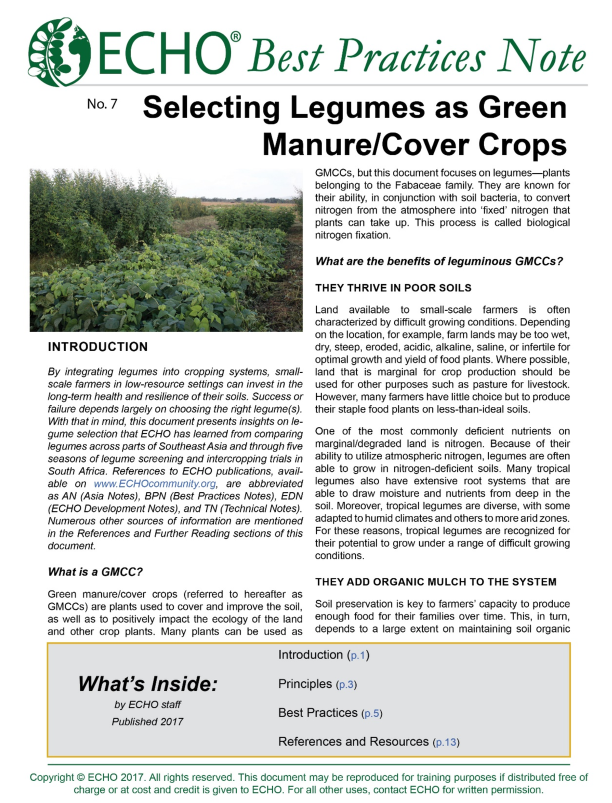
Dry Matter:

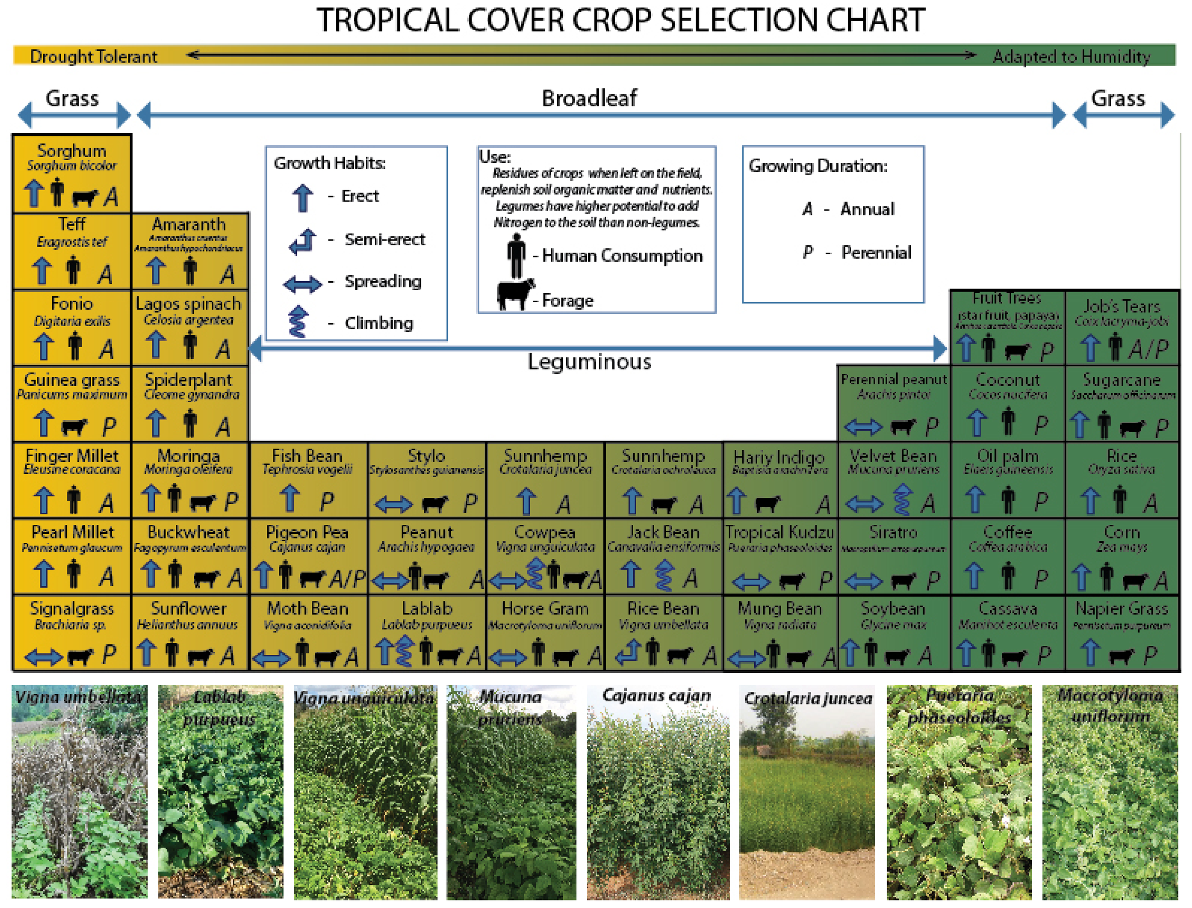


The amount of above-ground dry matter reflects how well a legume grows in a given location. Jack bean produced the most biomass in every location, generating the equivalent of 12 t/ha of dry matter in Bangladesh and the Philippines and 9 t/ha in Thailand. Rice bean generated close to 9 t/ha in Bangladesh and 6 t/ha in Thailand. Cowpea produced 5 or more t/ha in Bangladesh and the Philippines.

Resources Developed







SAMPLE GDD CALCULATION: For example, let us say that on a given day temperatures reached a minimum of 25°C and a maximum of 32°C.

Formula: GDD = ([maximum temperature + minimum temperature]/2) - minimum temperature for crop growth

The crop for which we are calculating GDD stops growing if temperatures drop below a minimum of 10°C. [For the sake of simplicity, a value of 10°C, commonly used for calculating GDD for maize, was used for calculating GDD for all the legumes in the Asia legume trial.] Therefore, the number of GDD for that day = ([32 + 25]/2) - 10 = 18.5. This is done for each day that the crop is grown, allowing you to track the cumulative number of GDD over the growing season.