

Nitrogen distribution analysis for all seeds of cowpea (*Vigna unguiculata*) using single-seed Near Infrared Spectroscopy

Haruki Ishikawa¹ and Kohtaro Iseki².



1. International Institute of Tropical Agriculture (IITA) 2. Japan International Research Center for Agricultural Sciences (JIRCAS)

Introduction

Cowpea (*Vigna unguiculata*) is an important crop for promoting the food security, livelihood, and cash income of farmers. Improved varieties should contain reasonable amounts of protein in the grains, and to ensure this, timely and cost-effective analytical methods strongly required. Recently, a procedure for estimating the cowpea grain nitrogen (protein) content in single seed using near infrared (NIR) spectroscopy was developed. The technique was able to estimate nitrogen content in intact seed within 20 sec (Ishikawa et al. 2017). In this study, evaluation of nitrogen content (%N) with all seeds in one plant was performed using single seed NIR technique.

H. Ishikawa, O. Boukar, C. Fatokun, M. Shomo, S. Muranaka (2017) /NIRS 25(3), 211-214.

Methods

Cowpea (TVu456) was cultivated at Ibadan, Nigeria. All seeds in a plant were collected with each position data (seed position and its weight, peduncle position, node number, branch number, flowering date of each peduncle, etc....) as explanatory variables, and nitrogen content of each seed was evaluated by single-seed FT-NIR technique. Total 10 plants were evaluated, respectively. Then, the multiple regression modeling and the Bayesian network modeling approaches was performed to aimed at formally describing interrelationships between explanatory variables and nitrogen content in the seed. Prior to model fitting, each variable was standardized to a mean of zero and standard deviation of one to account for the scale difference between features.

Results

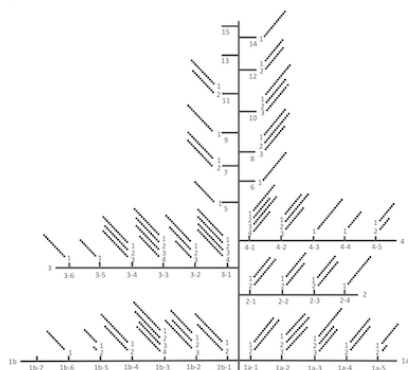
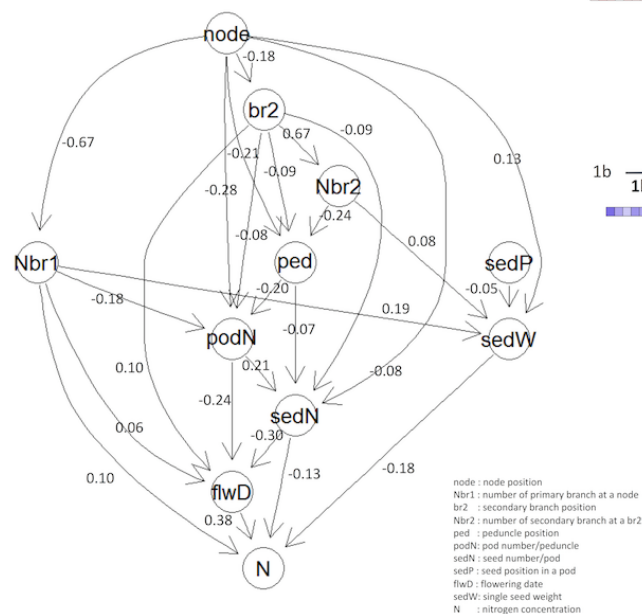


Figure 1. Seed distribution map

Node position (node), number of primary branch at a node (Nbr1), secondary branch position (br2), number of secondary branch at a br2 (Nbr2), peduncle position (ped), pod number/peduncle (podN), seed number/pod (sedN), seed position in a pod (sedP) were coded.



node : node position
Nbr1 : number of primary branch at a node
br2 : secondary branch position
Nbr2 : number of secondary branch at a br2
ped : peduncle position
podN : pod number/peduncle
sedN : seed number/pod
sedP : seed position in a pod
flwD : flowering date
sedW : single seed weight
N : nitrogen concentration

Figure 3. Directed acyclic graph of the multivariate regression model for seed on nitrogen content and its components using an exact search additive Bayesian model.

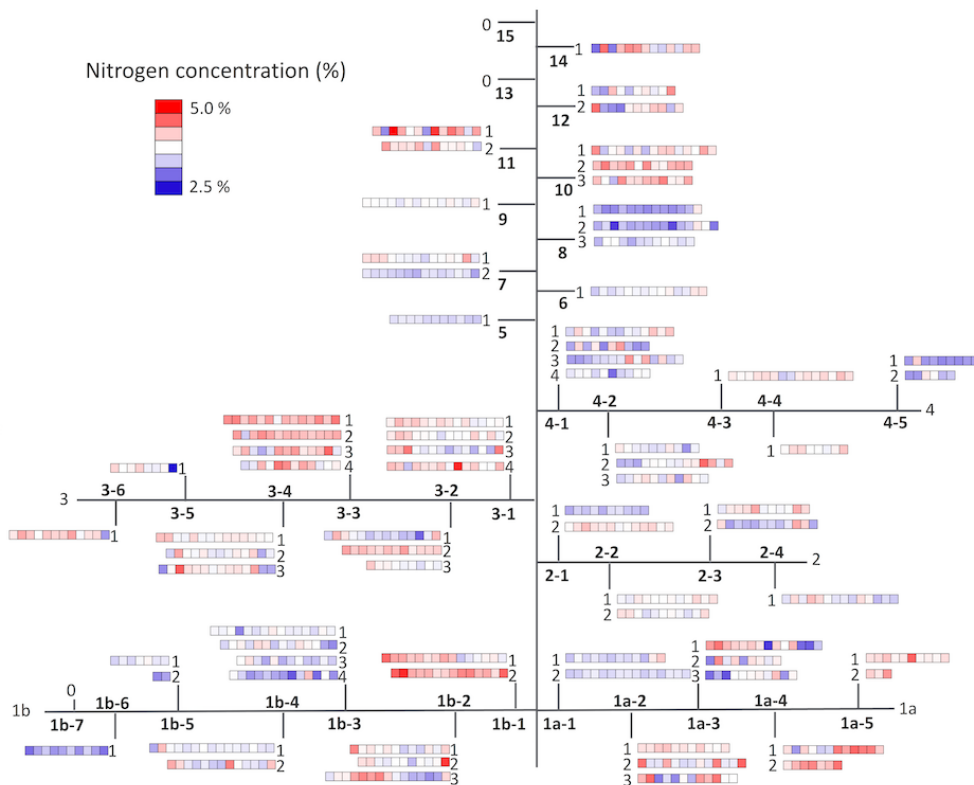


Figure 2. Nitrogen distribution map on a cowpea

Conclusions

-Seed nitrogen concentration (%) has positive relationship between flowering date and number of primary branch, and negative relationship between seed number/pod and seed weight.

-Seed position in a pod, peduncle position, number of secondary branch has no particular manner with nitrogen content.

-These results suggest that the plant of "less branch numbers", "less seed numbers" and "late flowering" become high nitrogen concentration in TVu456.

-Comparative analysis will be planned with several varieties to clarify varietal difference.

