World Pulses Day

#LovePulses for healthy diets and planet

Demand led breeding in action

Annuarite UWERA, Bean breeder, Rwanda Agriculture and Animal Ressources Development Board (RAB)

Date: 10 February 2021

INTRODUCTION

- Beans are priority for nutrition, food and income security in Rwanda.
  - Primary source of dietary proteins; "chicken" of the poor; "vegetable meat" of the wealthier urban dwellers
  - Increasingly becoming a commercial crop with a monthly turn-over of about 1 million US$, mostly in informal cross-border trade.
  - Important for health ecosystem
- Ranked 5th in terms of volume produced after bananas, Irish potato, sweet potatoes and cassava
- Beans are produced in all agro-ecologies of Rwanda either as bush or climbing varieties

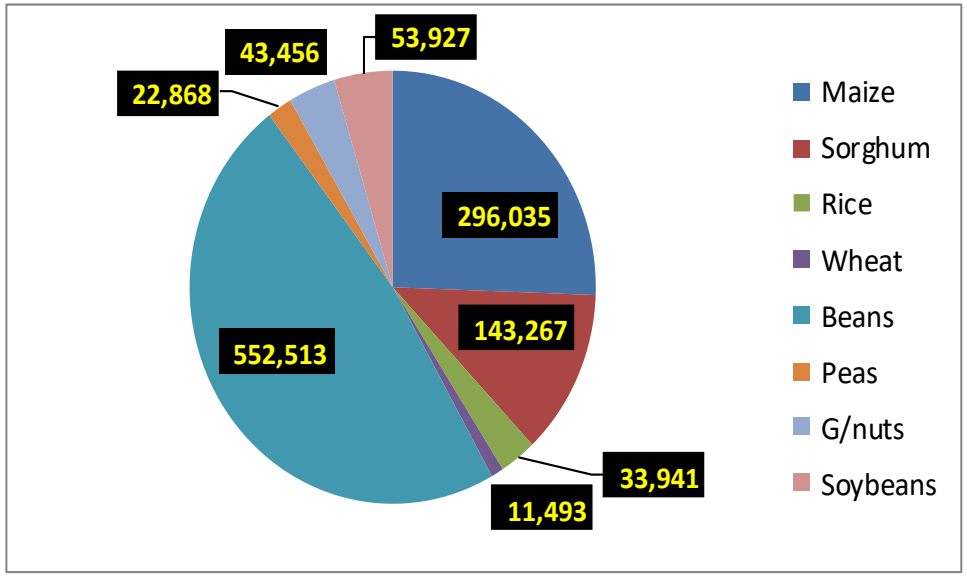


Figure 1: Mean land area (ha) cultivated to cereals and legumes in 2017/18 and 2018/19 cropping seasons

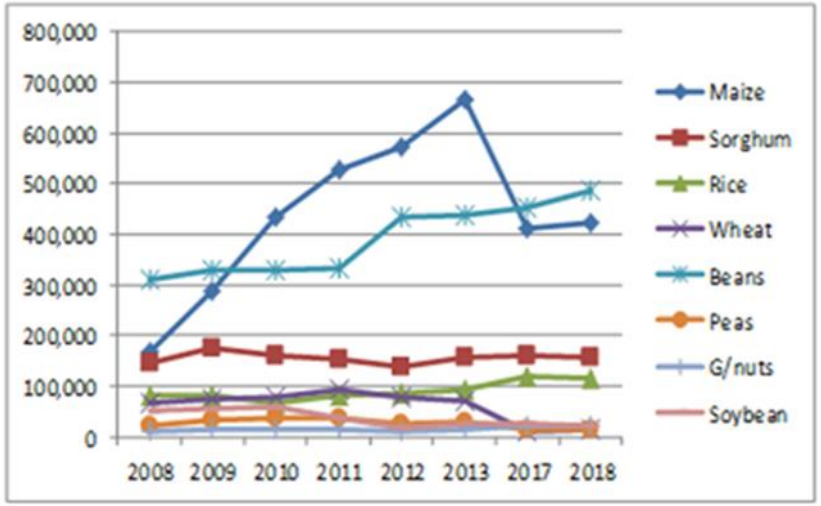


Figure 2: Evolution of crop production (MT) 2008-2018

OBJECTIVE OF RAB BEAN BREEDING PROGRAM

Develop farmers preferred, market demanded and climate resilient varieties

Developing and promoting the utilization of high yielding, multiple diseases resistant, marketable and nutrient rich bush, climbing and snap bean varieties

Promoting integrated soil fertility, diseases and pests, and staking management technologies that enhance sustainable productivity

Strengthening linkages among actors in the bean value chain to facilitate adoption, competitiveness and marketability of beans

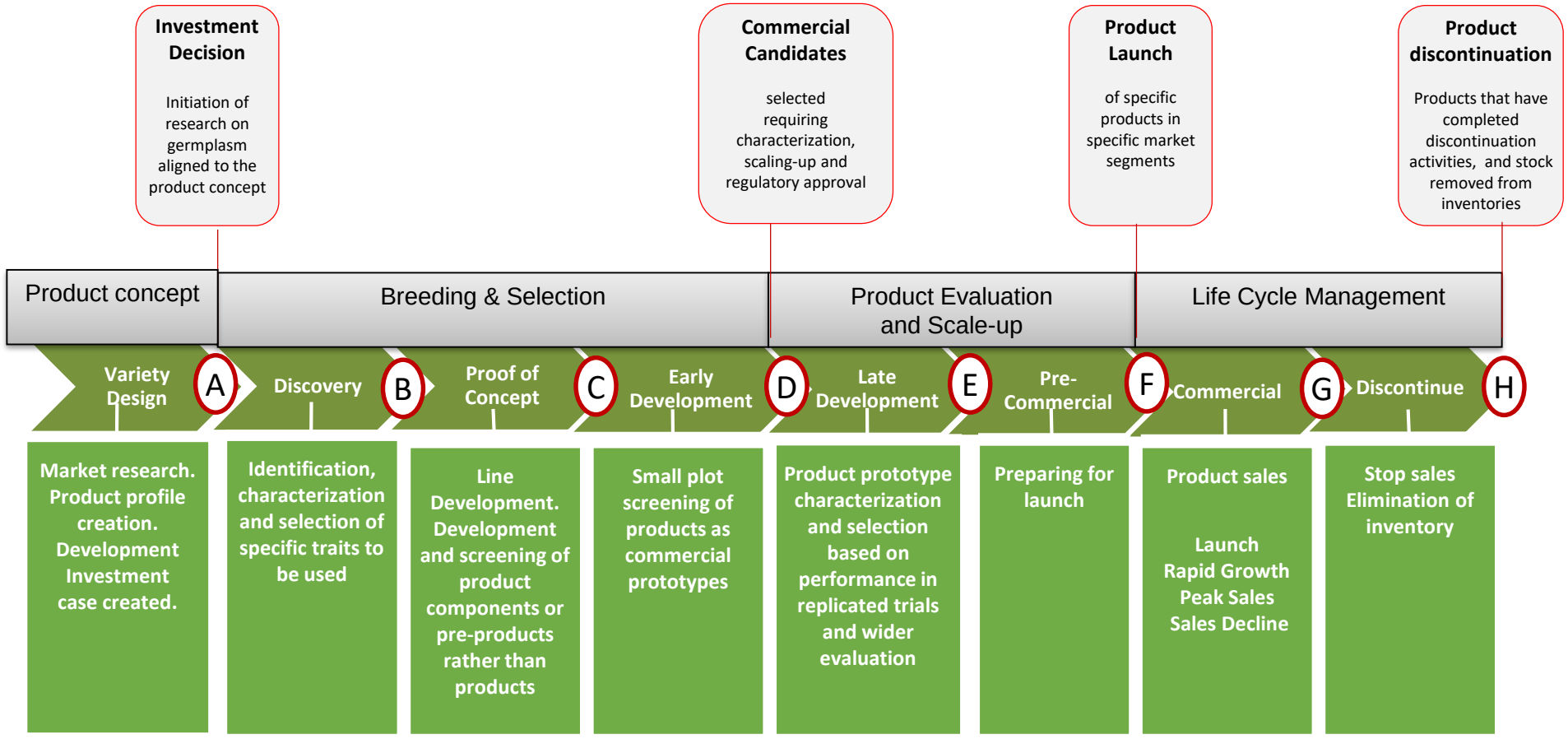
Establishing partnerships and collaboration with international researchers to broaden the skills and expertise for scientific excellence and resource mobilization.

RAB BEAN BREEDING PROGRAM LINKAGES TO DIFFERENT PARTNERS

Activity	Collaborating Partner
Trait Discovery	Michigan State University (USAID, USDA-NIFA); BecA ILRI, Alliance-PABRA, UC-Davis, ACIAR
Molecular breeding	KirkHouse Trust Foundation, ACIAR, ILRI-BECA
Conventional breeding, variety development, seed production, and dissemination	Alliance-PABRA (ECABREN), AGRA, Harvest Plus, ACIAR, Syngenta Foundation (SFSA)
Capacity building	Alliance-PABRA (ECABREN), AGRA, ROFORUM, Kirkhouse Trust, Michigan State, UC-Davis

Demand-led Breeding Stage Plan

Line progression decisions



Modified version of Syngenta Seeds stage plan

TRAITS PRIOROTIZATION TO RESPOND TO DEMAND

- ✓ Market oriented breeding and seed systems are the essential approaches to speed of better and more acceptable varietal diversity with better chances of adoption for higher bean productivity.
- ✓ Through multi stakeholder platforms (Business Innovation Platforms & Rwanda bean alliance), traits were prioritised

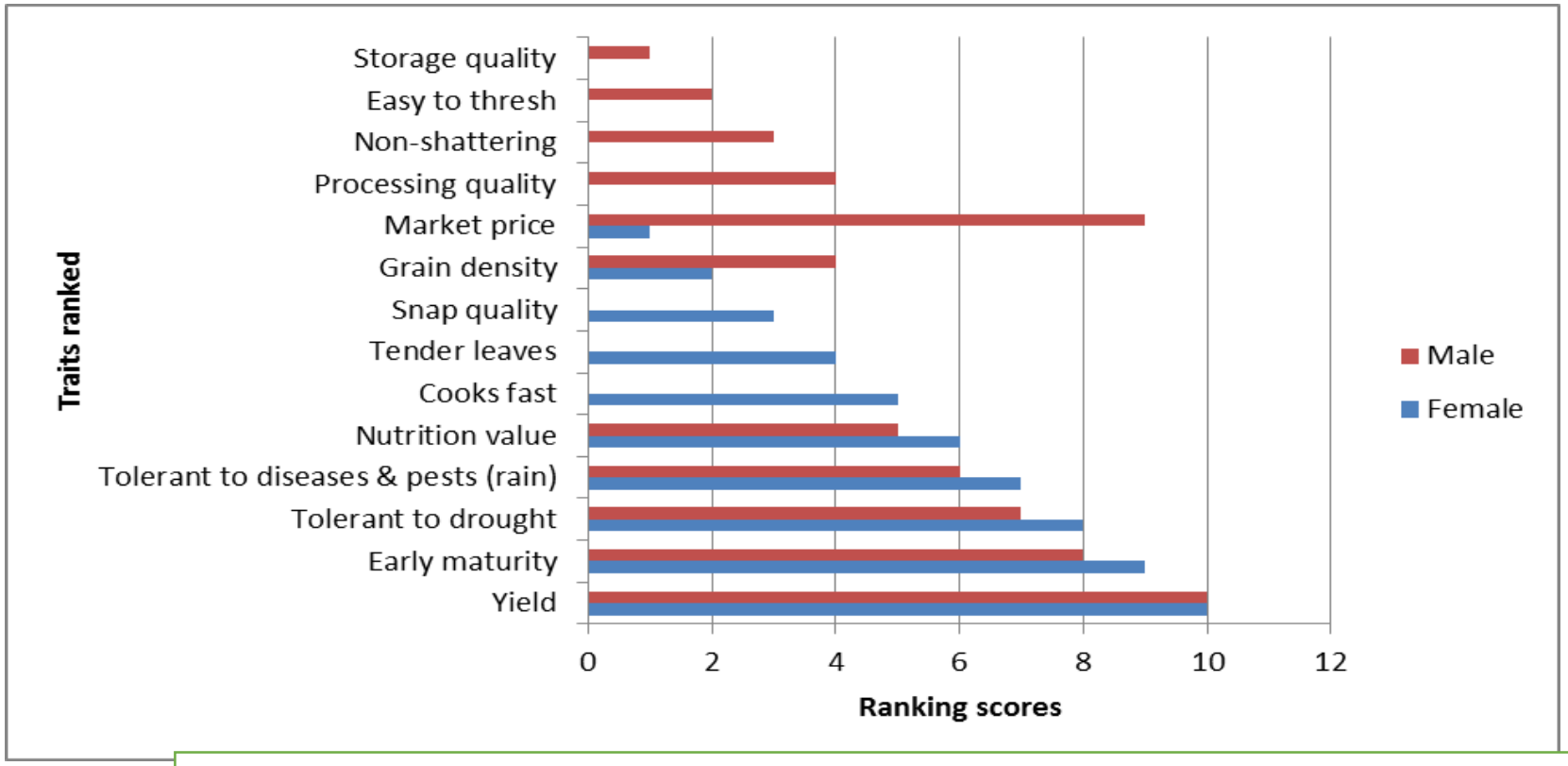


Figure 3: Priority traits in bean breeding program

RAB BEAN BREEDING PROGRAM, PRODUCT PROFILE

Developing responsive breeding pipeline and varieties that are developed to respond to farmers and off takers

Product profile	Large red mottled	Medium red mottled	Medium red	Large red kidney	Large-medium Sugar	Medium White	Medium Yellow	Medium –small Yellow
Variety to replace		RWR 2245				RWV 3006	G2331	
Growth type	Climber	Bush	Bush	Bush	Climber	Climber	Climber	Bush
Target agro-ecology	low, mid-high altitude	low-mid altitude	low-mid altitude	low-mid altitude	low-mid altitude	low-mid altitude	low-mid altitude	low-mid altitude
Target market	National and East Africa	National, East Africa, India and Asia	National, East Africa,' India and Asia	National, Eat Africa, India and Asia	National and East Africa	National and East Africa	National ,East Africa, Oman, Australia	National ,East Africa, Oman, Australia
Yield potential	2.5-4.0 T/Ha	1.5-2.5 T/Ha	1.5-2.5 T/Ha	1.5-2.5 T/Ha	2.5-4.0 T/Ha	2.5-4.0 T/Ha	2.5-4.0 T/Ha	1.5-2.5 T/Ha
Maturity	95-115 DM	75-95 DM	75-95 DM	75-95 DM	75-95 DM	75-95 DM	75-95 DM	75-95 DM
Abiotic stresses	Drought tolerance	Drought tolerance	Drought tolerance	Drought tolerance	Drought tolerance	Drought tolerance	Drought tolerance	Drought tolerance
Diseases	Resistance/tolerance to BCMNV, RR & Anthracnose	Resistance/tolerance to BCMNV, RR& Anthracnose	Resistance/tolerance to BCMNV,RR & Anthracnose	Resistance/tolerance to BCMNV,RR &Anthracnose	Resistance/tolerance to BCMNV, RR & Anthracnose	Resistance/tolerance to BCMNV, RR& Anthracnose	Resistance/tolerance to BCMNV, RR& Anthracnose	Resistance/tolerance to BCMNV, RR & Anthracnose
Iron & zn	Fe: 75-100ppm; Zn:30-40 ppm	Fe:70-90ppm; Zn: 30-35 ppm	Fe:70-90ppm;Zn:30-35 ppm	Fe:70-90ppm; Zn:30-35 ppm	Fe:70-90ppm;Zn:30-35 ppm	Fe:70-90ppm; Zn:30-35 ppm	Fe:70-90ppm; Zn: 30-35 ppm	Fe: 70-90ppm;Zn:30-35 ppm

Replacement plan for RWR 2245 by RWR 3194

RWR 2245

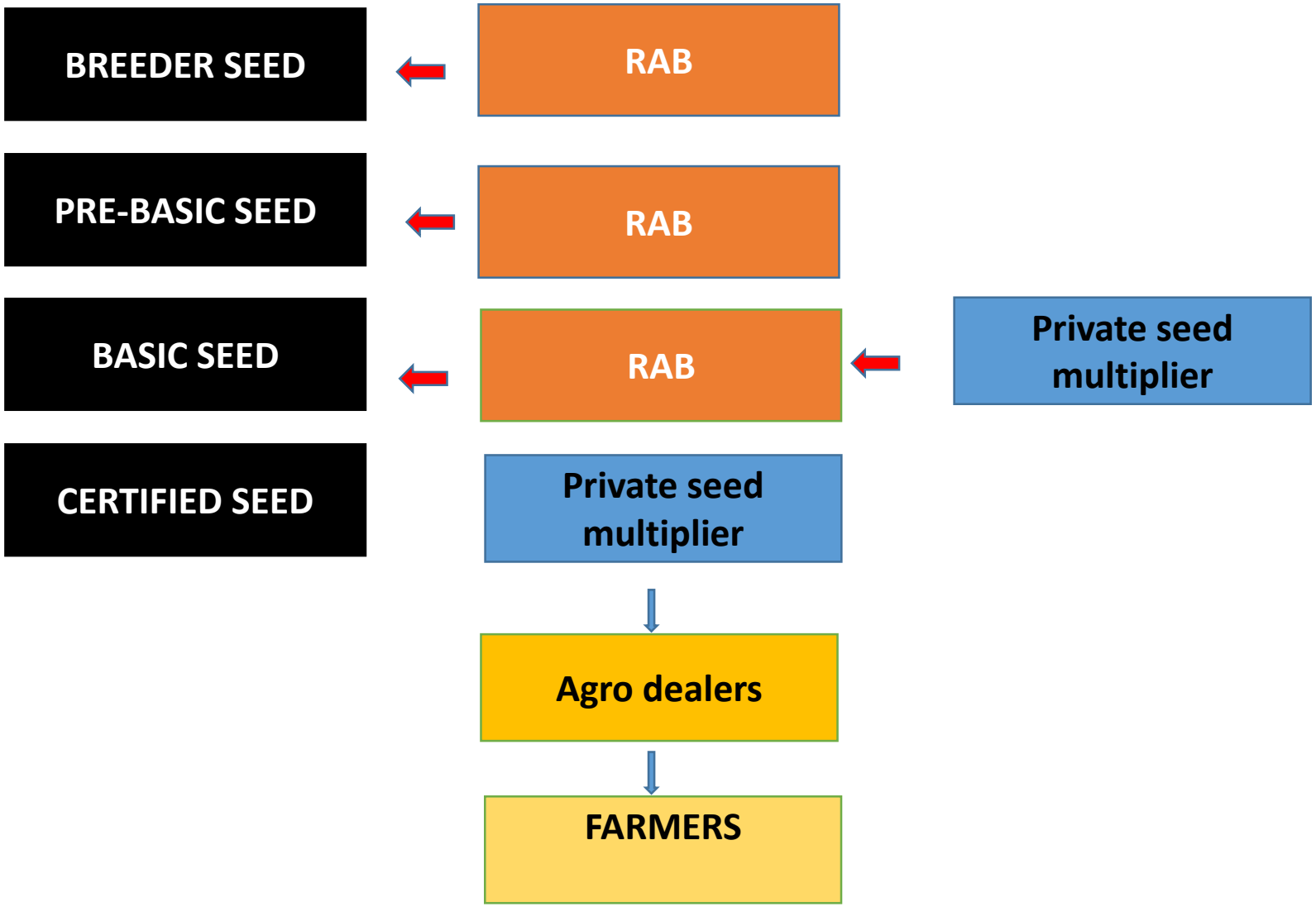
- ✓ Target clients: Farmers, traders, processors, consumers (women and children)
- ✓ Target markets: Local, regional, national and international export markets
- ✓ Market class: Red mottled

However, in the last four years, seed multipliers and researchers have reported RWR 2245 to be susceptible to anthracnose with decreased yield of 500 kg/ha.

RWR 3194

- ✓ high yielding (2,100 kg/ha compared to 2000kg/ha of RWR 2245),large-seeded
- ✓ has a high seed iron content (ppm) of 86-94 higher than 76 of RWR 2245;
- ✓ It is resistant to angular Leaf Spot, Anthracnose, Bean Common Mosaic Necrosis Virus, Common Bacterial Blight, Halo blight, *Fusarium solani*, *Pythium spp*.

CURRENT SEED SYSTEM IN RWANDA

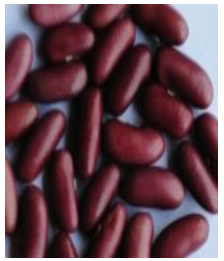


MAJOR ACHIEVEMENTS…..

2020 Annual bean grain demand among new off-taker investors Rwanda

No	Off-taker	Volume (MT)
1	Nourifam ltd	30,000
2	Enas	15,000
3	EAX	6,000
4	4B Holdings	3,000
5	Sarura	1,000
6	RGCC	1,000
7	Yak Fair trade	1,000
8	Farm fresh	700
9	BRG	500
10	Spring Integrated Co	500
11	Agri face	100
12	PANOVITA	100
13	NDENGU	100
Total		**59,000**

MOST PREFERRED VARIEIES BY OFFFTAKERS



Red and red kidney: RWV 3316,BOA5-1/16,NUA566

Red mottled: RWR 2245,MAC 44,RWR 3194,MBC23,MBC 71

Sugar beans: RWV3317,RWV 2872

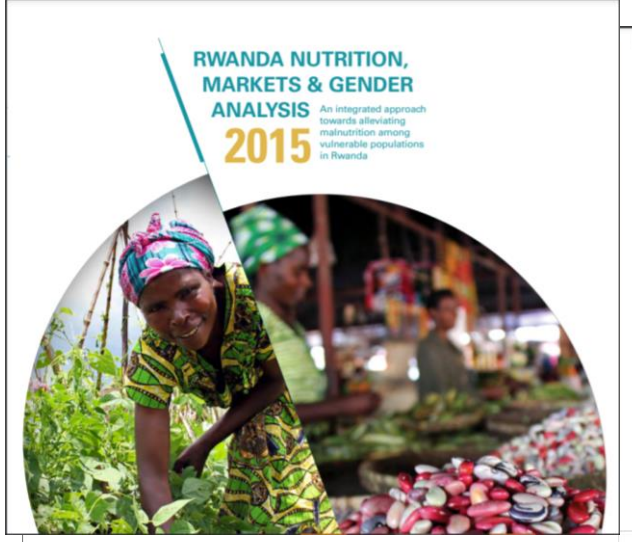
Colta

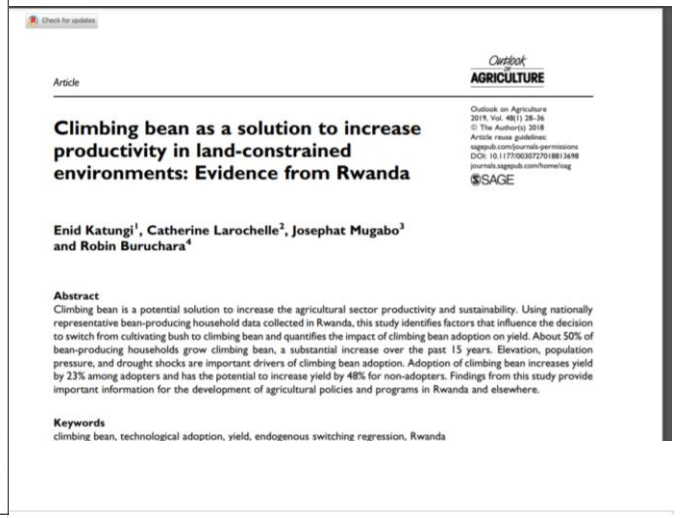
CAB2, RWV 3006

MAJOR ACHIEVEMENTS….

- ✓ Over 100 bean varieties released over 20 years of which several are released in other East and Central African countries; Burundi, DRC, Kenya, Ethiopia, Tanzania and Uganda

- ✓ Proof of concept of biofortification in common bean happened in Rwanda 10 varieties rich in Fe and or Zn micro-nutrients being released in 2012
- ✓ Current adoption of biofortified beans is at 28% of adoption
  - Biofortified beans have been shown to improve work capacity
  - Increase farmers income
  - Raised hemoglobin levels
  - Positive effect on cognitive ability in Rwanda females and brain function
  - Adoption of climbing bean increases yield by 23% among adopters and has the potential to increase yield by 48% for non-adopters.





Outlook AGRICULTURE

Article

Climbing bean as a solution to increase productivity in land-constrained environments: Evidence from Rwanda

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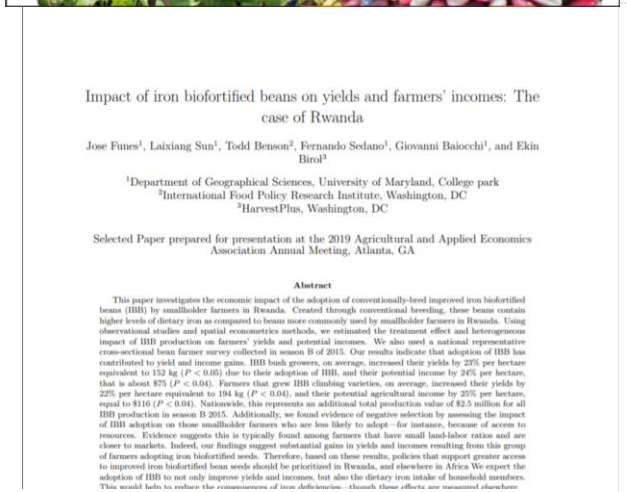
Enid Katungi[1], Catherine Larochelle[2], Josephat Mugabo[3] and Robin Buruchara[4]

Abstract

Climbing bean is a potential solution to increase the agricultural sector productivity and sustainability. Using nationally representative bean-producing household data collected in Rwanda, this study identifies factors that influence the decision to switch from cultivating bush to climbing bean and quantifies the impact of climbing bean adoption on yield. About 50% of bean-producing households grow climbing bean, a substantial increase over the past 15 years. Elevation, population pressure, and drought shocks are important drivers of climbing bean adoption. Adoption of climbing bean increases yield by 23% among adopters and has the potential to increase yield by 48% for non-adopters. Findings from this study provide important information for the development of agricultural policies and programs in Rwanda and elsewhere.

Keywords

climbing bean, technological adoption, yield, endogenous switching regression, Rwanda



Impact of iron biofortified beans on yields and farmers' incomes: The case of Rwanda

Jose Funes[1], Laixiang Sun[1], Todd Benson[2], Fernando Sedano[1], Giovanni Baiocchi[1], and Ekin Birol[3]

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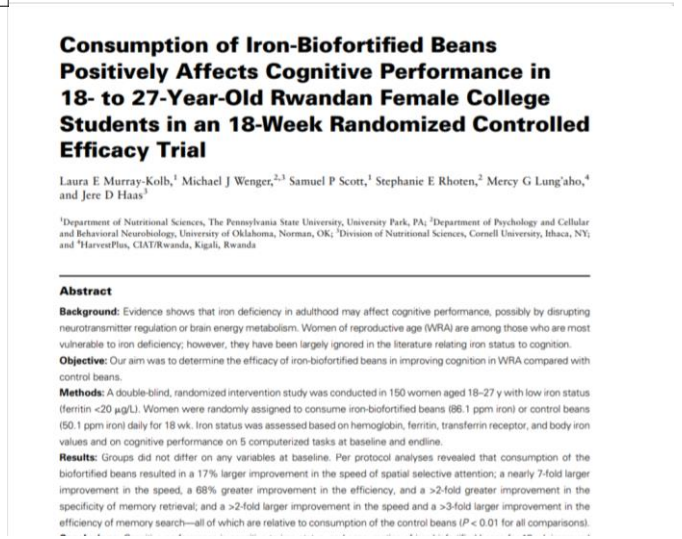
Selected Paper prepared for presentation at the 2019 Agricultural and Applied Economics Association Annual Meeting, Atlanta, GA

Abstract

This paper investigates the economic impact of the adoption of conventionally-bred improved iron biofortified beans (IBB) by smallholder farmers in Rwanda. Created through conventional breeding, these beans contain higher levels of dietary iron as compared to beans more commonly used by smallholder farmers in Rwanda. Using observational studies and spatial econometrics methods, we estimated the treatment effect and heterogeneous impact of IBB production on farmers' yields and potential incomes. We also used a national representative cross-sectional bean farmer survey collected in season B of 2015. Our results indicate that adoption of IBB has contributed to yield and income gains. IBB bush growers, on average, increased their yields by 23% per hectare equivalent to 152 kg ($P < 0.05$) due to their adoption of IBB, and their potential income by 24% per hectare, that is about $75 ($P < 0.04$). Farmers that grew IBB climbing varieties, on average, increased their yields by 22% per hectare equivalent to 194 kg ($P < 0.04$), and their potential agricultural income by 25% per hectare, equal to $116 ($P < 0.04$). Nationwide, this represents an additional total production value of $2.5 million for all IBB production in season B 2015. Additionally, we found evidence of negative selection by assessing the impact of IBB adoption on those smallholder farmers who are less likely to adopt—for instance, because of access to resources. Evidence suggests this is typically found among farmers that have small land-labor ratios and are closer to markets. Indeed, our findings suggest substantial gains in yields and incomes resulting from this group of farmers adopting iron biofortified seeds. Therefore, based on these results, policies that support greater access to improved iron biofortified bean seeds should be prioritized in Rwanda, and elsewhere in Africa We expect the adoption of IBB to not only improve yields and incomes, but also the dietary iron intake of household members. This would help to reduce the consequences of iron deficiencies—though these effects are measured elsewhere.



Consumption of Iron-Biofortified Beans Positively Affects Cognitive Performance in 18- to 27-Year-Old Rwandan Female College Students in an 18-Week Randomized Controlled Efficacy Trial

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Abstract

Background: Evidence shows that iron deficiency in adulthood may affect cognitive performance, possibly by disrupting neurotransmitter regulation or brain energy metabolism. Women of reproductive age (WRA) are among those who are most vulnerable to iron deficiency; however, they have been largely ignored in the literature relating iron status to cognition.

Objective: Our aim was to determine the efficacy of iron-biofortified beans in improving cognition in WRA compared with control beans.

Methods: A double-blind, randomized intervention study was conducted in 150 women aged 18–27 y with low iron status (ferritin <20 μg/L). Women were randomly assigned to consume iron-biofortified beans (86.1 ppm iron) or control beans (50.1 ppm iron) daily for 18 wk. Iron status was assessed based on hemoglobin, ferritin, transferrin receptor, and body iron values and on cognitive performance on 5 computerized tasks at baseline and endline.

Results: Groups did not differ on any variables at baseline. Per protocol analyses revealed that consumption of the biofortified beans resulted in a 17% larger improvement in the speed of spatial selective attention; a nearly 7-fold larger improvement in the speed, a 68% greater improvement in the efficiency, and a >2-fold greater improvement in the specificity of memory retrieval; and a >2-fold larger improvement in the speed and a >3-fold larger improvement in the efficiency of memory search—all of which are relative to consumption of the control beans ($P < 0.01$ for all comparisons).

OUR VISION

- ✓ Continually develop more superior farmer preferred and market demanded varieties;
- ✓ Accelerate variety access in partnership with private sector;
- ✓ Engaging policy makers to continue supporting bean value chain development including research;
- ✓ Increase the adoption of HIBs;
- ✓ Strengthen linkages between key value chain actors;
- ✓ Reinforce contract arrangement among value chain actors;
- ✓ Increase farmers awareness on the use of quality seed;
- ✓ Ensure the sustainability of seed supply in the system.

Thank you!

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