

Multi-location Testing of Vegetable Varieties of APSA-
WorldVeg Consortium Members in Benin and
Tanzania

Research Proposal

Prepared for

The Asia and Pacific Seed Association (APSA)

Under the

APSA-WorldVeg Vegetable Breeding Consortium

By

World Vegetable Center

Proposal Summary

Project title	Multi-location Testing of Vegetable Varieties of APSA-WorldVeg Consortium Members in Benin and Tanzania	
Submitted to	APSA	
Main WorldVeg contact person	Mandy Lin (mandy.lin@worldveg.org)	
Main WorldVeg scientists	Dr. Peter Hanson	
Project duration	22 months (1 March 2021-31 December 2022)	
Funding requested (US\$)	172,074 (for 15 companies)	Minimum of 5 companies with US\$15,000 per company*
		Maximum of 15 companies with US\$12,000 per company

*Special arrangement can be done if less than 5 companies are interested.

Objectives

The overall objective is to enable members of the APSA-WorldVeg Vegetable Breeding Consortium to create new business deals with African seed companies and distributors, thereby contributing to the increased availability of quality seed of improved vegetable varieties to smallholder farmers in Africa. The specific objectives are:

- 1) To test the performance of vegetable varieties of APSA-WorldVeg consortium members in two locations in Africa (Tanzania and Benin) using scientifically sound methods.
- 2) To collect feedback about the variety performance from consumers, farmers and seed companies through well-organized field days.
- 3) To facilitate business deals between APSA-WorldVeg consortium members and seed distributors in Africa.

Background

Consumer demand for vegetables is increasing quickly in Africa, driven by income growth, urbanization and a growing recognition of vegetables as an important part of healthy diets. However, the vegetable seed sector has been slow to develop and there remains a lack of well-adapted, high-performing vegetable varieties. Lacking own capacity in variety development, many African seed companies import vegetable seed from Europe, North America or Asia. There is much potential for these companies to establish partnerships with APSA consortium members as many varieties developed for the Asian market may also be suitable for the African market and perform well under African conditions.

There is therefore much to be gained from testing and promoting existing vegetable varieties of APSA consortium members for their performance in countries in West and East Africa where the vegetable seed sector is underdeveloped. Little such research has been done and recent initiatives such as Fair Planet Seeds (<https://www.fairplanetseeds.org/>) and Seeds2B (<https://seeds.aatf-africa.org/>) show the importance of doing variety trials and the potential for substantial impact.

The World Vegetable Center is in an ideal position to conduct variety trials and create market opportunities because it has regional offices in Tanzania and Benin (as well as in Mali) with qualified staff and active vegetable breeding programs. These locations do not cover all major climatic zones in Africa, but starting the trials in a few locations with

established WorldVeg stations and staff ensures the quality of the results. Gradually more sites can be added in subsequent years. WorldVeg has also established the African Vegetable Breeding Consortium (AVBC) in 2018 under the umbrella of the African Seed Trade Association (AFSTA). This network of companies can be utilized for this initiative to extend the geographical scope of the trials and provide benefits to companies in Asia and Africa alike.

In this project, WorldVeg will therefore facilitate the formation of stronger partnerships between seed companies in Africa and Asia. Members of the APSA-WorldVeg Vegetable Breeding Consortium will be able to explore, at minimal cost, new market opportunities for selling their varieties in Africa through local African companies.

Proposed Methods/Activities

The project duration is 22 months. It is proposed that the project would focus on the following crops of key importance to the African market:

1. Tomato (Benin and Tanzania)
2. Chili pepper (Benin)
3. Sweet pepper (Tanzania)
4. Onion (Benin and Tanzania)

Multi-location trials require a coordinated and systematic approach to test materials in different production environments. WorldVeg proposes the establishment of a multi-location testing network encompassing different agro-ecological zones in East and West Africa:

- A **Cotonou and/or Malanville, Benin:** targeting market opportunities in the humid and semi-arid areas of West Africa, including Benin, Nigeria and Ghana.
- B **Arusha, Tanzania:** targeting market opportunities in East Africa, including Tanzania, Kenya, Uganda, Ethiopia, and Rwanda

It is noted that the list of crops and identified locations can be adjusted for a future project. For instance, World Vegetable Center also has a station in Bamako, Mali, which could target market opportunities in the dryland areas of West Africa.

Activity 1. Generate and share information about desired plant traits

WorldVeg will provide APSA-WorldVeg consortium members with key information for each crop about:

- Market requirements: fruit size, shape, color, firmness, shelf life, etc.
- Information about market preferences for hybrids (vs. OPVs), names and characteristics of the main varieties available in the market
- Farmer-desired plant types (e.g. determinate, semi-determinate).
- Minimally required disease resistance
- Minimally required tolerance to abiotic constraints, if any

Project members can select their best-bet varieties for testing based on this information.

Activity 2. Multi-location variety testing

Seed companies contributing to this project will provide entries (mostly existing varieties that were successful in the Asian market) that match the identified farmer and consumer traits. Companies do not need to have a presence in the country, but may just ship seed

from elsewhere to test how it performs in new locations. The trial will be repeated for two seasons and companies can either choose to repeat the same material or provide other material for 2022. Companies can use the performance data to register their varieties locally, depending on registration requirements; however, it is not the responsibility of WorldVeg to do the registration.

The trials will be managed by highly qualified WorldVeg staff and conducted mainly at WorldVeg stations, which have suitable conditions for conducting the experiments, are fenced to prevent grazing animals to enter the trials, and have security to prevent unauthorized persons from entering the trials. One additional trial is proposed for Malanville, Benin to test suitability for semi-arid conditions. WorldVeg has partnered with a local farmer with suitable conditions and has successfully run variety trials in this field in 2018-2019.

The following scientific methods will be applied for conducting the trials:

1. The entries submitted by seed companies (2-3 varieties per crop) will be coded so field staff conducting the trials and other seed companies will not know the identities.
2. Trial design and performance data to be collected are summarized in the table below.
3. The data from the variety trials will be provided to all project members and include the names of the varieties and names of the companies that provided them. Sharing this information is important to assess the relative performance of varieties and to inform potential business partners in Africa. High quality photos of the variety trials and harvested fruits will be provided to the project members.

Table 1. Work plan for APSA multilocation trials in Benin and Tanzania

Benin-Specific Information:			
Trial locations	a. Cotonou, Benin, WorldVeg station (Humid Region) b. Malanville, Benin, farmer's field (Semi-arid Region)		
Check varieties	Tomato 1 Padma 2 Cobra	Chili Pepper 1 TBD 2	Onion 1 TBD 2
Tanzania-Specific Information:			
Trial location	c. Arusha, Tanzania, WorldVeg station (Highland)		
Check varieties	Tomato 1 Tanya 2 TBD	Sweet Pepper 1 California Wonder 2 TBD	Onion 1 TBD 2
General information:			
Trial Entries	Commercial varieties entered by APSA consortium members		
Experimental design	RCBD with 3-4 replications, repeated for 2 seasons		
Planting plans and data sheets	WorldVeg will prepare the planting plan and data sheets for each trial. Entries will be coded.		
Data collection	Digital data collection (using Akvo Flow) or paper data sheets		
Weather data	Air temperatures (mean, minimum, maximum), rainfall, humidity		

Suggested date of planting:			
a. Benin, humid	April		
b. Benin, semi-arid	October		
c. Tanzania, highlands	May		
Trial Specifications:	Tomato	Chili/sweet pepper	Onion
	2 rows per plot	2 rows per plot	6 rows per plot
	30 plants per plot	30 plants per plot	~360 plants per plot
	Staking	No staking	No staking
	3-4 harvests	4 harvests	Single harvest

Table 2. Traits to be measured in APSA multilocation trials in Benin and Tanzania

Tomato	Chili/Sweet Pepper	Onion
Days to 50% flowering	Days to 50% flowering	Bolting %
Days to 50% maturity	Days to 50% maturity	Days to maturity (60-70% fallen tops)
Plant stand at harvest	Plant stand at harvest	Plant stand at harvest
Marketable yield from each harvest	Marketable yield from each harvest	Marketable bulb yield
Unmarketable yield from each harvest	Unmarketable Yield from each harvest	Leaf number per plant*
Average fruit weight from 2 nd harvest	Average fruit weight (sweet pepper)	Average bulb weight (10-15 bulbs)
Fruit shape & uniformity	Fruit length, width and height	Average Bulb length, width (10-15 bulbs)
Brix at full red ripe	Pungency (chili)	Pungency
Internal and external color at full red stage	Color measured on full red fruit	Bulb color
Shelf life and deterioration on breaker stage fruit	Color taken from green fruit (if applicable)	% Doubling (measured on 10-15 bulbs)
Shelf life and deterioration on full red fruit	Shelf life and deterioration on breaker stage fruit	Shelf life
TYLCD severity every 3 weeks (if it appears). Score each plant in the plot and calculate average	Virus severity every 3 weeks (if it shows up)	Disease incidence and severity (purple blotch, pink root, etc.
Early blight severity as needed (score each plant in plot and calculate average)	Anthrachnose as needed (score each plant at green fruit and red fruit stages. Calculate average of the plot)	
Late blight severity as needed (score each plant in plot and calculate average)	Bacterial wilt incidence at harvest	
Bacterial wilt incidence at harvest	Other disease severity scored if it shows up	

* Randomly selected from 10 plants per plot. WorldVeg Variety Trial Guides are available for each crop and provide additional detail

Activity 3. Evaluation by farmers, consumers and traders

Farmers, consumers, traders (and technical staff of African seed companies) will be invited to inspect the field trials at harvest time and will be asked to evaluate variety performance for crop-appropriate traits. Participants will be asked to assess fruit/bulb characteristics for overall market acceptability (shape, size, external and internal color), transportability (shelf life, firmness), and consumer appeal (taste, texture, aroma etc.).

Activity 4. Business development

World Vegetable Center will organize field days for potential business partners to visit the trials. Participating companies are encouraged to participate in the field day to inspect the trials, assess the varieties and interact with potential business partners. WorldVeg will advertise the field days to local businesses through its network of contacts, through the African Seed Trade Association (AFSTA), and through the media. WorldVeg will make available facilities for business talks between companies during the field days.

Deliverables

1. A report about desired plant traits per location (Activity 1)
2. A report showing variety performance in the multilocation trials with data and photos (Activity 2)
3. A report about the trial evaluation by farmers, consumers and traders (Activity 3)
4. Field days and facilitated business talks (Activity 4)

Duration and Budget*

Budget item	Cost (US\$)
Personnel	55,595
Supplies & operations	64,000
Training & workshops	18,400
Travel	6,000
Sub-total	143,995
Indirect costs (19.5%)	28,079
Total	172,074

*Budget is estimated for the maximum 15 companies.

Timeline of activities

Activity	2021												2022											
	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
Market trait info.	█	█																						
Seed shipments	█													█										
Field trials			█	█	█	█	█	█							█	█	█	█	█					
Field days							█	█	█									█	█	█				