Impact Pathway Worksheet (Feel free to expand rows and columns as needed).

Name of your CRSP Project (Shorter version): Biological Nitrogen Fixation (BNF)
Lead PI: Dr. Mark Westgate, ISU

			STEP 1		STEP 2		STEP 4: P		
ID#	Program Activity		Project Outputs (expected by FY 12)	When to be achieved?	Next Users	Final Users	Step 4.1	Step 4.2	Step 4.3
1a	Evaluate effectiveness of stacked inoculant on local and improved germplasm		Quantitative relationships between local environmental conditions and genetic response to inoculants established	Sep-12	Research stations and selected farmers	Small landholder Farmers	Identify local varieties and demonstration sites for field testing	Complete initial assessment of G x E, refine variety list	Confirm Trial I resuts, initiate on-farm trials
	STEP 5	FY 10					Obtain Seed for popular varieities	Establish Trial I in three agro-ecological zones in each country	Quantify yield of inoculant trial season 1
		FY 11						Field trial 2 established on research stations and selected on-farm trials	Quantify yield advantage of inoculation for Fiield Trial II
		FY 12							Field trial 3 established to confirm on-farm G x E
2a	Identify parental materials for inheritanc		Germplasm (for parental materials) with enhanced BNF identified	Sep-12	Researchers	Breeders, IARCS	Select germplasm for evaluation with high and low BNF	Screen for BNF response to inoculants in US and HC	Test for BFN response to specific stresses
	STEP 5	FY 10					Obtain experimental and adapted germplasm	Screen for increased BNF in low soil N +/- inoculants	Initiate Greenhouse BNF screenings
		FY 11						Screen germplasm for BNF in low soil in HC field trials	Greenhouse trials initiated
		FY 12						Complete screenings	Complete greenhouse trials
2b	Phenotype existing mapping population		Iinitial set of new QTLs for response to inoculation identified	Sep-12	Researchers	Breeders, IARCS	Secure mapping populations for analysis	Establish field trials for phenotypic analysis	Correlate BFN response under field and controlled conditions
	STEP 5	FY 10					Increase seed of mapping populations for QTL analysis	Begin field testing of parental lines and selected populations	
		FY 11						Initiate phenotyping for divergent response of BNF	Establish correlative response of BNF in field and GH trials
		FY 12							
3c	Strengthen farmers' collective capabiliites		knowledge and recommendations generated from Inoculation trial results	Sep-12	farmers	ag business concerns	Add inoculation information to PELUM agenda	Create appropriate information format for dissemination	Meet with key farmer groups in each HC
	STEP 5	FY 10					Incorporate BNF/inoculant information in PELUM activites		
		FY 11						Create training materials for distribution to PELUM farmers	Conduct advocacy meetings with farmer groups
		FY 12							Conduct PELUM meetings in Rwanda, Uganda and Tanzania to present results of farmer profitability to 200+ partners
4	Train students, field technicians		Students, staff, farmers trained on ways to utilize, manage, and improve BNF	Sep-12	staff, farmers	graduate students	identify beneficiaries	Identify beneficiaries of training programs	Train farmers and staff for research station and on-farm trials
	STEP 5	FY 10					Identify graduate and undergraduate students for research programs	Graduate and undergraduate students identified, enrolled	HC visiting scientist training completed
		FY 11						Farmer cooperators identified	Farmer and staff training completed
		FY 12							

			Program Logic (identify steps to reach next users and final users to achieve the vision of success) add columns if needed				
ID#	Program Activity		Step 4.4	Step 4.5	Step 4.6	Step 4.7	Step 4.8
1a	Evaluate effectiveness of stacked inoculant on local and improved germplasm		Test selected/advanced germplasm in zones with defined ecological limitations	Identify unique responses/limitations for improving seed yield across agro-ecological zones	Identify consistent response/limitations for improving seed yield across agro-ecological zones	Test optimum combinations of germplasm and inoculant for each ecological zone	Confirm optimum combinations of germplasm, inoculant, soil management for small - farm profitability
	STEP 5	FY 10					
		FY 11					
		FY 12	Quantify yield and economic advantage of inoculation in third season	Establish initial relationships between local agro-ecological conditions and G x E			
2a	Identify parental materials for inheritanc		Advance positive response lines to field testing in US and HC.	Correlate reponse to inoculation in GH and field trials	Confirm G x E response for selected germplasm	Link G X E response to nodule occupancy/ efficiency	Relate BNF levels to rhizobia strains occupying nodules
	STEP 5	FY 10					
		FY 11	Test parental lines for BNF in field				
		FY 12	Complete parental line testing in the field	Confirmed correlative response of BNF in field and GH trials	Completed characterization of GXE for increased/stable BNF	Establish nodule rhizobia occupancy on selected lines	Confirm nodule rhizobia occupancy on selected lines
2b	Phenotype existing mapping population		Advance RILs for SSR marker analysis	Conduct SSR marker analysis on selected lines	Complete initial analysis of potential new QTLs	Advance selected RILs to F3 for QTL analysis	Test selected RILs in agro-ecological zones to confirm QTLs for response to inoculation
	STEP 5	FY 10					
		FY 11	Advance selected RILs to F2				
		FY 12	RIL populations phenotyped for BNF response	RIL populations populated with SSR markers			
3c	Strengthen farmers' collective capabiliites		Share project results through PELUM network in HCs	Engage external funding agencies through HC ag stakeholders	Develop locally-relevant information materials for dissemination to PELUM network farmers	Develop extension training and farmer advocacy programs to promote access to inoculant technologies	Conduct PELUM meetings in all network countries
	STEP 5	FY 10					
		FY 11					
		FY 12	Incorporate research results into extension training programs, farmer advocacy and PELUM website in HCs	Determine potential for engaging international funding agencies to expand current technology transfer efforts			
4	Train students, field technicians		Initiate graduate student research projects	Complete graduate student research projects	Develop scientific publications from graduate theses research	Graduate degrees awarded	
	STEP 5	FY 10					
		FY 11	Graduate student research projects underway				
		FY 12		Research results analyzed for review by BNF team	Reports, theses, and publications submitted to major professors		

ID#	Program Activity		STEP 3 Vision of Success	STEP 3 Expected time to achieve the vision
1a	Evaluate effectiveness of stacked inoculant on local and improved germplasm		Best combinations of varieity and inoculants determined for 9 agro-ecological zones in Uganda, Rwanda, Tanzania	2015
	STEP 5	FY 10		
		FY 11		
		FY 12		
2a	Identify parental materials for inheritanc		Germplasm with superior nodulation characteristics identified and made available to breeding programs to improve BNF	2012
	STEP 5	FY 10		
		FY 11		
		FY 12		
2b	Phenotype existing mapping population		QTLs for response to inoculation confirmed and employed in breeding programs to improve BNF	2015
	STEP 5	FY 10		
		FY 11		
		FY 12		
3c	Strengthen farmers' collective capabiliites		Fifteen (15) percent of farmers in all 12 SSA countries in PELUM network using innoculum technology	2014
	STEP 5	FY 10		
		FY 11		
		FY 12		
4	Train students, field technicians		All degree programs, internships, and visiting scientist activities successfully completed	2012
	STEP 5	FY 10		
		FY 11		
		FY 12		