NATP PME notes 11

Task Force on Prioritization, Monitoring & Evaluation

Prioritization of Production Constraints
Concepts and Methods

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March 2003

Why prioritization?

The limited and scarce research resources need to be allocated judiciously and rationally to enhance the research efficiency. At the same time the problems confronting agriculture sector have become more complex and challenging with lesser and lesser resources available. The donors are also viewing the priority setting as an important activity for judiciously allocating resources.

It is therefore the production constraints are to be prioritized before setting a need-based research portfolio. The ranking of production constraints can be done based on their potential damage to production. To improve the research efficiency and to attain the larger impact of agricultural research, the stakeholders need to be involved in that process.

How prioritization done earlier?

The priority setting is not a new concept. It was always done but differently. Earlier, the problem identification was based on knowledge and experience, which used to be subjective. With changes in research management, the priorities use to be changed. Often the peers determined the priorities. Important forums used to be the research advisory committees, staff research councils, quinquennial review teams, seminars, conferences, etc. These priorities were either disciplined-based or component-specific.

What is new paradigm?

In the new paradigm shift, the priorities are determined more objectively by greater involvement of the stakeholders. The process involves development of clear and transparent criteria for establishing choices among alternative research strategies. It also involves multi-disciplinary approach and client oriented system rather than component. The approach supplements qualitative judgment of the peers with quantitative analysis. It also incorporates the national and regional objectives.

Steps for prioritizing constraints

Step I: Delineation of target domain: Delineate the homogenous target domain for identifying production constraints. To identify the target domain, regions need to be delineated into homogenous agro-ecoregions. In the National Agricultural Technology Project (NATP) framework, the whole country is divided into five agro-ecoregions: (i) arid, (ii) coastal. (iii) hill and mountains, (iv) irrigated, and (v) rainfed. After the first level of delineation, each agro-ecoregion is further divided into homogenous production systems and sub-production systems. For more details, see PME note 6.

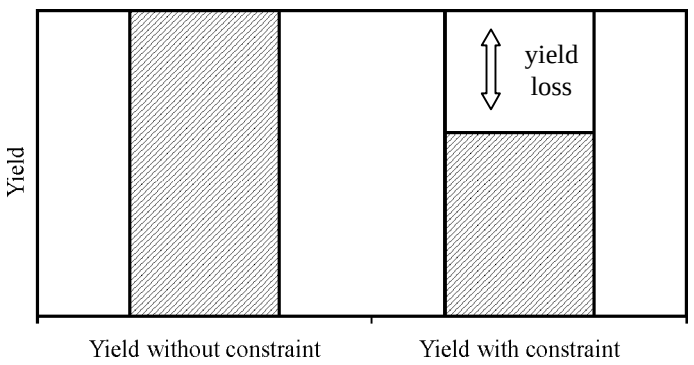
For example, the rainfed agro-ecoregion is divided into four production systems: (I) rice-based, (ii) coarse cereal (nutrition)-based), (iii) oilseed-based, and (iv) cotton-based. To identify and prioritize these agro-ecoregions have been further divided into homogenous clusters. For example the oilseed-based system is further divided as soybean-based, groundnut-based, rapeseed & mustard-based, etc. The groundnut-based sub-production system is further divided into homogenous target domains as rabi groundnut, kharif groundnut and summer groundnut. These can be also grouped as groundnut in peninsular India and groundnut in Saurashtra region. The constraints and opportunities in different sub-zones will be different. Clubbing them for identification of priorities will give erroneous prioritization of constraints.

Step II: Identify production constraints: This can be done at three stages. Exhaustive review of Annual Reports, perspective Plans (e. g. Vision 2020 documents), and other literature can be scanned to list the production constraints. It should be followed by group discussion with the concerned scientists, extension specialists, and input traders. Once the list of constraints is finalized, the farmers may be interviewed. The last step can be done either through rapid rural appraisal, participatory rural appraisal, focused group meetings or personal interview depending upon the budget and time availability. Past experiences showed that focused group meetings and rapid rural appraisal were more rewarding.

Step III: Estimate losses caused due to a constraint: Once the production constraints are identified, these need to be quantified in terms of loss incurred. Three criteria may be used to prioritize the production constraints: (i) yield loss due to the specific constraint. (ii) extent of the specific constraint (area affected by that constraint), and (iii) probability of occurrence of specific constraint. Yield loss due to specific constraint can be measured by taking the difference between the yield with and without that constraint (Figure 1).

Step IV: Prioritize constraints for a commodity: Estimate the loss as a result of specific constraint. It is estimated by multiplying the yield loss, extent of production constrain, probability of occurrence and the output prices. In case of livestock, the constraints are adjusted by incorporating the duration of a particular constraint in the year of specific period. Box 1 and 2 illustrate the computation of losses incurred due to specific constraint in crop and livestock. It is done for all constraints. Rank the production constraint for a given crop or livestock species for a given region (Box 3) Higher the loss due to a specific constraint, higher will be the rank. Sort all the constraints depending upon their magnitude of loss.

Figure 1 : Estimation of yield loss due to production constraints



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Box 1. Calculation of crop losses in soybean-based production system

Constraint: Soil salinity in soybean

Data:

n = area affected = 30 per cent of soybean area
p = probability of occurrence = 1(every year)
l = loss per unit of area = 35 kg per ha
N = total soybean area = 8 million hectare
P = price of soybean = Rs 8 per kg

Calculation:

Value loss =n*p*1*N*P
= 0.30*1*35*8*8
=Rs 680 million

Box 2. Calculation dairy losses in soybean-based production system

Constraint: Mineral deficiency in crossbred cattle

Data:

n = proportion of cattle affected = 100 per cent
p = probalility of occurrence = 1
l = loss of milk per cattle = 323 liter
d = duration affected in a year = 100 per cent
N = population of cattle = 40.2 thousand
P = price of milk = Rs 8 per liter

Calculation:

Value loss = n*p*1*d*N*P
= 1*1*323*1*40.2*8
= Rs 103.87 million

Box 3. Top 10 constraints in different crops and dairy in soybean-based production system

Rank	Soybean	Wheat	Chickpea	Dairy
1.	Non-podding/pod shattering	Moisture stress	Pod borer	Failure of artificial insemination
2.	Seed and stem rot	Soil salinity	Wilt	Mineral deficiency
3.	Moisture stress	Weeds	Cut worm	Foot and mouth disease
4.	Weeds	Black rust	Termites	Mastitis
5.	Soil salinity	Termites	Luxuriant growth	Fodder shortage
6.	Girdle beetle	Rodents	Root rot	Hemorrhagic septicemia
7.	Organic matter Deficiency	Zinc deficiency	Rust	Prolapse
8.	Bihar hairy Caterpillar	Poor crop Establishment	Moisture stress	High abortion
9.	Phosphorus Deficiency	Brown rust	Poor crop Establishment	Late calving
10.	Tobacco Caterpillar	Leaf rust	Weeds	Black quarter

Step V: Prioritize constraints for the production system: Pool all constraints of various crops in the production system, and then rank according to the magnitude of loss occurred. The list will provide the prioritized production constraints for the production system of sub-system.

Step VI: Develop R&D portfolio: Develop alternative technology options for alleviation of the production constraints, For example drought is the constraint. The possible research options may be crop improvement through genetic enhancement, crop management through agronomic manipulation or through watershed approach. Assess expected research cost and benefits of alternative technology options for alleviation of the constraints. While estimating the benefits, expected yield gains, probability of research success and adoption history of improved technologies may be taken into consideration. This generates a ranking of options based on expected benefit-cost ratio.

An illustration

Box 3 gives the list of top 10 production constraints for wheat, soybean, chickpea and livestock in the soybean-based production system. In case the research agenda is to be developed for specific crop or enterprise, crop wise research proposals may be invited. If the research agenda is to be developed for entire production system of sub-production system, the production constraints of all the crops and enterprises may be merged and then ranked based on the damage incurred by the constraints. Box 4 shows that the moisture stress in wheat, pod borer in chickpea, soil salinity in wheat, non-podding in soybean and weeds in wheat were the top 5 production constraints in the soybean-based production system. Livestock constraints are also listed among top 10 production constraints in the soybean-based production system. These are related with failure of artificial insemination and foot and mouth disease. This suggest that in a system's perspective, all constraints across commodities and enterprises are prioritized. The approach may be adopted for prioritizing the research portfolio for each National Agricultural Research Project (NARP) zones.

Box 4. Top ten constraints in soybean-based production system

Rank	Crop	Constraint
1	Wheat	Moisture stress
2	Chickpea	Pod borer
3	Wheat	Soil salinity
4	Soybean	Non-podding
5	Wheat	Weeds
6	Dairy	Failure of artificial insemination
7	Soybean	Seed/ stem rot
8	Soybean	Moisture stress
9	Dairy	Mineral deficiency
10	Dairy	Foot and mouth disease

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