Setting Breeding Objectives and Priorities

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Setting Breeding Objectives and Priorities – Why?

- The « ultimate » goal of breeding: value creation
- Breeding before breeders
- The rise of breeders and the call for objectives
- Modernity and the cry for priorities
Study Approach

- General survey (Survey Monkey) – 110 responses
- Case studies – Few responses, moderate depth
- Other sources
General Survey Responses

Type of Breeding Organization

- Private
- Public
- Public-private partnership

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
General Survey Responses

Respondent's Role in the Organization

- Breeder: 70%
- Non-breeder scientist: 10%
- Research manager: 20%
- Product developer: 0%
- Other: 0%
General Survey Responses

Target Geography

- Africa
- Asia
- Australia/Oceania
- Europe
- North America
- South America
- Worldwide

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
General Survey Responses
Survey Approach

- Agree/Disagree
- Testing of facts’ intensity
- General bias towards agreement
Definitions – Breeding Customers

- Growers: individuals or organizations who grow plants or raise animals with the aim of harvesting or collecting one or more specific products (grain, whole plant, tubers, milk, meat, wool, etc.).
- Product chain: individuals or organizations who take products harvested or collected by growers, possibly transform them (although not necessarily), and provide them to end-use consumers. In some cases, growers can also be considered as product chain.
- End-use consumers: individuals or organizations who use products for food, feed, or energy. In some cases, growers can also be considered as end-use consumers.
Definitions – Markets

- Market segment: a geographic area or a group of people having a relatively homogeneous demand for a commodity (here crop varieties or animal breeds). The population of users who make up a market segment may all be located in a single agro-ecology or this population may be distributed across several different agro-ecologies. The extent to which an agro-ecology and a market segment coincide will depend on the extent to which user demand (preferences) for a breeding product are determined by climate, soils and land-use constraints.
Definitions – Products

- Product profile: set of targeted attributes which a new plant variety or animal breed is expected to meet to be released onto a market segment. Attributes must be understood as traits with a specific value, this value being defined either in absolute or relative terms. For instance, a product profile may list grain yield (11 tons/hectare or more), or tolerance to downy mildew (same as or better than variety X), total oil content (no less than variety Y).
Connecting Needs and Actions

- Process perceived as being formal
- Absence of many and essential formal elements
Defining Markets

Use of Quantitative Market Segment Data

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Don’t know
- No answer
Defining Markets

- Most data is qualitative
Defining Markets

- Heavy reliance on internal sources
Defining Markets

- Heavy reliance on internal sources
Defining Markets

- Precise market analyses not generalized.
- No specific market data sources / examples have been provided.
- Market knowledge often “collected” directly by breeders through interactions with market actors (growers, chain, end-users), especially in smaller organizations.
- Market definition charged to marketing groups in larger organizations.
Market Segments and Socio-Economic Classes

- Relatively homogeneous approach across organization types
Market Segments and Socio-Economic Classes

- North America, least concerned by socio-economic segmentation
Market Segments and Gender

- Tremendous difference between public and private organizations
- Mostly a public “concern”
Market Segments and Gender

- Huge variation across regions (headquarters)
- Mostly an African “concern”
- Almost ignored in the developed world
Slightly stronger in private than public organizations
Perception most likely ahead of reality
From Market to Breeding – Product Profiles

- Slightly simpler objectives in public than in private organizations
## From Market to Breeding – Product Profiles

<table>
<thead>
<tr>
<th>Trait</th>
<th>Reference</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>Check1 +5%</td>
<td>1</td>
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<tr>
<td>Lodging resistance</td>
<td>&lt;20%</td>
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<tr>
<td>Plant height</td>
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<tr>
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<tr>
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<tr>
<td>Al soil tolerance</td>
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</table>

**Market demands**

1. Must-have; 2. Important; 3. Nice to have
## From Market to Breeding – Product Profiles

<table>
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<th>Trait</th>
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<th>Priority</th>
<th>Selection Objective</th>
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### Breeding opportunities

1. Must-have; 2. Important; 3. Nice to have
Breeding and Traits

Many of the quantitative traits that constitute the primary focus of plant breeding are very complex in inheritance, with variation believed to be attributable to dozens if not hundreds of underlying genes. It is not unusual to identify 20 chromosome regions affecting yield or other key agronomic traits in a bi-parental, marker-based mapping project in maize. If only 20 key genes segregate independently in a breeding project, the favorable gene combination for all 20 loci occurs in an F2 at such a low frequency that growing the F2 population over the entire U.S. corn acreage would be insufficient to provide a 95% chance that the most favorable genotype would occur. Even if the F2 population were randomly inbred to fixation, several million inbred lines would be required to have reasonable chance of recovering the favorable genotype. Clearly, breeders rarely, if ever, recover the optimum genotype from their breeding crosses. With low heritabilities, small sample sizes, and breeding approaches involving rapid inbreeding, the simple goal of achieving a gene combination significantly better than the parental genotypes is an ambitious undertaking with relatively low odds of success. By employing genetic markers in a recurrent selection scheme as discussed above, our aim is to improve the fixation rate of favorable QTLs by using recurrent cycles of marker-based selection. In a practical sense, we would like to accomplish this within reasonable experiment sizes and within and among modestly sized populations and to use three or more generations per year in multiseason nurseries or greenhouses.

# From Market to Breeding – Product Profiles

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<th><strong>Desired Impact</strong></th>
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### Strategy

1. Must-have; 2. Important; 3. Nice to have
From Market to Breeding – Product Profiles

- Huge diversity in what is understood by product profile (and resulting documents)
- Product profiles are not breeding strategies
  - Lack current performance context
  - Lack termed decisions
- Strategies often undetermined or determined by non value creation-driven elements
- Beware of changing market demands
More direct involvement of all stakeholders in public than in private breeding programs
Decision-Making

- Often breeder, alone
- Crop teams with representatives from marketing, development, breeding
Growers are a strong focus for all regions
End-consumers are most important for programs based in Africa and Latin America
Socio-economic factors mostly taken into account in developing countries
Trait Prioritization

- Reality often quite different from intentions
- Tremendous impact of operational constraints
  - Early breeding stages
  - Late breeding stages
Trait Prioritization

- Unresolved complexity often leads to lack of demonstrable gains
  - Selection indices

\[ l = b_1 X_1 + b_2 X_2 + \ldots + b_n X_n = \Sigma b_i X_i \]

- Prioritization based on value creation
  - Increased growing area (“market share”)
  - Increased income
Markets and Types of Varieties

- Significant differences between public and private organizations
Breeding Technologies and Approaches

- Significant differences between public and private organizations
Consideration for Gender

- Of all the factors that were presented, gender is the least taken into consideration, overall.
Conclusions & Learnings

- Setting breeding objectives and priorities almost unanimously recognized as desirable / good practice
- Facts often lagging behind intentions
- Numerous “parasitic” elements / constraints
  - Changing market “pull”
  - Operational constraints
- Most successful breeding programs generally had / have clear and persistent objectives and priorities
Conclusions & Learnings

- Not obvious / certain if there are best practices
- Market knowledge
- Realistic ambition
- Significant improvements / deliveries