Advanced agronomic training needs and priority agricultural research in Turkey

Yalvac K.

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Advanced agronomic training needs and priority agricultural research in Turkey

Kenan Yalvac
Ministry of Agriculture and Rural Affairs (Turkey)

Abstract. This paper covers defining of agricultural research priority areas and training needs linking with them in Turkey. The methodology used in this study, was developed by Forster et al (1986) in USA, and adapted to agriculture in Australia (CSIRO 1991).

17 Areas of Research Opportunities (AROs) for Turkey's agriculture were defined in general terms to account for the full range of research activities being undertaken by the research institutes. Each ARO was assessed as to the return to Turkey from research and development, based on four independent scoring criteria, that are potential benefits to Turkey of the ARO, Turkey's ability to capture these potential benefits, research and development (R&D) potential in the ARO, and R&D capacity in regard to the ARO. Scores for attractiveness and feasibility for each ARO were derived from the scores for these four criteria. Attractiveness was calculated as the product of the potential benefits to Turkey in the ARO, and Turkey's ability to capture these benefits. Feasibility was calculated as the product of the technical potential of relevant areas of R&D, and the current capacity to realise this R&D potential and achieve the technology goals in an efficient and timely way. The AROs were grouped according to high, medium or low priority. 85 research programs were identified, and their priorities were established by a similar process to the one utilised to determine ARO priorities. Comparisons between current investment and investment required for future priority research were made based on the basic relative priorities of AROs.

Resources allocated by the General Directorate of Agricultural Research (GDAR) to all these research programs were inadequate and there were not sufficient trained staff. High priority research programs where R&D capacity is limited by skills, knowledge, and facilities were identified within each ARO, and investments in facility improvement were linked to these programs. Following the same procedure, advanced training needs were identified by directed towards high priority research programs with low R&D capacity caused by limited skills and knowledge.

Key words. Training needs – Research priorities – Attractiveness – Feasibility – Turkey.

Introduction

The agriculture sector has provided the highest portion of GDP until 1978. Its share declined from 36.9 % in 1970 to % 13 in 1997, due to the increasing emphasis on industrialisation. Although the importance of agricultural sector has been gradually declining, it still generated 13% of total GNP in 1997 and 11.7% (2.7 billion US Dollars) of export earnings in 1996. In addition, the part of industries (food, textile and leather) that based on agricultural raw materials, generated around 54.4% of exports earnings. Besides, 35% of total population living in rural areas and 44.6% of the labour force is engaged in agricultural activities in 1997.

The challenge to the sector is to develop further and meet the needs of both domestic and international markets into the next century. To be successful, Turkey's producers and processors must be competitive. Innovation and technical improvement by both groups will be fundamental to achieving this goal.

Historically, research has contributed significantly to the Turkish agriculture. For example, a part of the increases in production and efficiency gains achieved by many of Turkey's agricultural industries from the 1950s up to now can be attributed to the adoption by farmers of the products of research. Agricultural research could continue benefiting to Turkey's economy, but must be equipped to do so by having the resources, skills and organisational capacity and ability to respond to needs as they arise.

The special circumstances of agriculture in Turkey justify a much expanded public investment in agricultural research. The great majority of the agricultural researches on crop, animal, food and aquaculture are performed by the institutions of General Directorate of Agricultural Research (GDAR) in the Ministry of Agriculture and Rural Affairs (MARA). Further, the research institutes of the General Directorate of Rural Services (GDRS) under one of the State Ministries conduct research on hydrology, soil and water conservation, irrigation and drainage, soil productivity, plant nutrition, mechanisation and agricultural economics. In addition, researches on forestry, sugar beet, tea and tobacco are respectively done by the Ministry of Forestry (MOF), the Sugar Company, the Tea Company and the General Directorate of Turkish Monopoly. Atomic Energy and Nuclear Research Association of Turkey studies on plant nutrition and breeding, soil fertility, food storage and animal health by using nuclear techniques. Besides, Agriculture Faculties run quite a bit research projects as thesis work and special projects on various fields, which are mostly supported by Scientific and Technical Research Association of Turkey (TUBI-TAK) and the Government budget. The agricultural economy departments of Middle East Technical and Hacettepe Universities also deal with the some basic researches on their own fields.

Apart from the state institutions, few private sector companies which are generally the subsidiary of the seed companies make adaptation studies on imported plant varieties. These studies are mostly concentrated on vegetables, maize, sunflower, soybean, millet and safflower cultivars. However some private companies also make researches on agronomy and plant protection.

At the beginning of 1990's, the service was not able to deliver the needed high quality and relevant research, and the return on the current public investment in research was low. High returns were achievable, but would not occur unless the national research service was reformed and strengthened. General Directorate of Agricultural Research (GDAR) has accepted the above situation and prepared Agricultural Research Master Plan (ARMP). This Plan clearly identifies GDAR's Mission which is:"***Providing econo - mic, social and environmental benefits to Turkey through high quality and relevant agricultural research***". To achieve this mission GDAR started implementing the policies that were:

❏ Focus research activities on priority research areas.

❏ *Improve the capacity to deliver priority research through training*, collaborative research programs, better access to, and communication with international researchers and research results, and through monitoring and evaluating research outcomes.

❏ *Develop multi-disciplinary research teams and a critical mass of scientists in high priority research areas*.

❏ Improve the management and effective use of resources available for agricultural research.

❏ Foster an environment that encourages individual and teams of research workers to improve performance.

❏ Promote the transfer of technology and the value of agricultural research to Turkey.

ARMP defined the GDAR's roles as development of agriculture research policy in terms of allocating resources to priority research programs and provision of leadership, opportunities for training, improved collaboration, communication and information systems along with development of personnel policies and research advocacy. Research Institutes' role is to deliver research outputs. The relationship between GDAR and the Research Institutes is largely a contractual one. GDAR is responsible for research policy including research program priorities. Research institutes submit research projects related to achieving the outcomes of priority research programs. Each research project is assessed according to a set of agreed criteria and high priority programs approved for funding.

GDAR has developed ***nine goals*** that will assist to achieve its' Mission. These are:

❏ To determine research priorities and allocate funds to priority research programs and projects.

❏ To contract, monitor and evaluate research.

❏ To implement a human resource development program.

❏ To develop and implement management information systems.

❏ To develop and implement research knowledge, information and communication systems.

❏ To strengthen co-ordination of agricultural research and collaboration among providers and end-users of research.

❏ To improve the impact and relevance of the research service.

❏ To increase resources and efficiency of resource use for agricultural research in Turkey.

❏ To develop a structure for GDAR and the research institutes that best reflects their functions.

In the ARMP, each goal has defined outcomes, recommendations for implementation and detailed action plans based on justification and discussion of the goal outcomes.

This paper will only cover limited outcomes of ARMP, such as defining research priority areas and programs, and their training needs.

I – Materials and methods

1. Research Priority Setting

Research carried out by the national agricultural service in Turkey should be selected and funded according to systematically determined priorities. Having priorities and managing resources are essential to achieve effective focus and to obtain the maximum return on investment in research. Furthermore, agricultural research must compete successfully with other uses for public funds, so the products of research must have value to the economy and to the Turkish people for significant allocations to be made to support it. Without the guidance to resource allocation that priorities can provide, research investments will be productive only by chance. For those reasons, the need for priorities is critical.

The methodology used to determine the priorities was developed for industry in the USA (Forster *et al.*, 1986), and later used in agriculture in Australia (CSIRO, 1991). It has been used extensively in a number of advanced countries, and has proven to be a valuable approach to research priority setting, especially where the priorities must take account mixed social, economic and environmental objectives.

Research priorities were determined by a two-step process.

A. Step 1

A priority setting workshop was held in October 1994. The workshop was attended by research administrators, staff from various national and regional research institutes, representatives from the associated government research organisations dealing with soil and water, plant nutrition, conservation of natural resources and forestry, and other stakeholders from the public and private sector. The broad range of backgrounds and responsibilities they represented ensured that the priorities determined at the Workshop were appropriate for Turkey.

Areas of Research Opportunities (AROs) were defined in general terms to account for the full range of research activities being undertaken by the research institutes co-ordinated by the GDAR, and output based and in most cases represented broad agricultural products.

All participants were provided with detailed information on possible AROs and with other materials as follows:
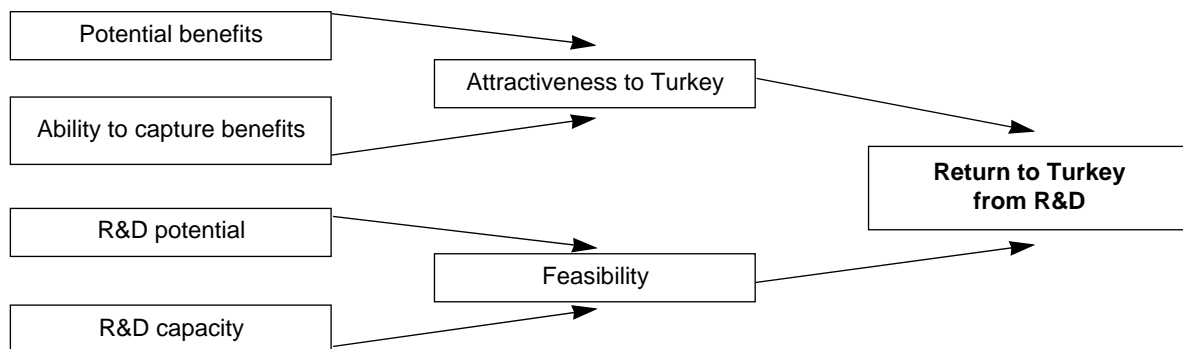
❏ An outline of the priority setting approach and methodology.

❏ A list of areas of research opportunity (AROs) covering the research mandate of GDAR.

❏ Data and evaluation sheets for each ARO.

❏ Sample scoring sheets for the four assessment criteria (potential benefits, ability to capture, R&D potential, R&D capacity.

❏ Worksheets listing the factors to be considered in scoring each of the criteria.

❏ Recent reviews of the sub-sectors represented by the AROs).

The workshop started with updating the AROs. GDAR Working Groups provided the background information required to prepare Data and Evaluation Sheets for each ARO. Each ARO was assessed as to the return to Turkey from research and development, based on four independent scoring criteria. The independent criteria were: *potential benefits* to Turkey of the ARO, Turkey's *ability to capture these potential benefits*, *R&D potential* in the ARO, and R&D capacity in regard to the ARO. Scores for two indices, which are *attractiveness* and *feasibility* for each ARO were derived from the scores for these four criteria. *Attractiveness* was calculated as the product of the *potential benefits* to Turkey, namely the maximum economic, social and environmental returns possible from technical improvement in the ARO, and Turkey's *ability to capture these benefits*, as measured by industry's ability to convert technical progress into commercial or other returns. *Feasibility* was calculated as the product of the technical potential of relevant areas of R&D, and the current capacity to realise this R&D potential and achieve the technology goals in an efficient and timely way.

Attractiveness is determined by assessment of such factors such as international and national market forces and Government policies, over which researchers and research managers have no influence. *R&D feasibility*, by contrast, is influenced in the short and longer term by actions such as changing the level and mode of use of resources available for research, and by investing in training to provide the necessary skills. The overall rating of the expected benefit, or the return to Turkey, of successful research to achieve a particular ARO, was assessed by examining the balance between the relative attractiveness and relative feasibility scores (Figure 1).

Figure 1. Research assessment framework illustrating the criteria which contribute to attractiveness and feasibility and, in turn, their contribution to the "return to Turkey from R&D".

The participants made a preliminary scoring on the four independent criteria described above: *potential benefits*, *ability to capture*, *R&D potential*, and *R&D capacity*. The key points to be taken into account for each of the four criteria were reviewed with the participants prior to scoring. An interactive group review of the first round of priority scores was made. The review permitted a sharing of information by the participants, providing a better basis for assessment. The scores of individuals were then revised as necessary.

The revised scores were used to produce an overall Workshop scores of the four assessment criteria for each ARO. These averaged Workshop scores were then depicted in three graphs; first one for *attractiveness* where potential benefit was plotted against ability to capture benefits, second one for *feasibility* where R&D potential was plotted against R&D capacity, and the third where attractiveness was plotted

against *feasibility*. The *attractiveness* versus *feasibility* screen, depicts the *basic relative priorities* for agricultural research for the next decade.

The outcome of the process was a systematically derived ranking and grouping of the AROs according to their basic relative priorities. The separate ranks of the AROs for attractiveness and feasibility gave the same basic groupings of high, medium, and low priority AROs. Based on the above evaluation, comparisons were made between current investment and investment required for future priority research.

B. Step 2

The second step in the priority setting process was to review potential research programs and to define their *basic relative priorities* in each of the AROs. This task was undertaken by small working groups and workshops to determine priorities of programs within each ARO.

Small specialist working groups were established to review the potential programs identified for each of the AROs. Priorities for programs were established by a similar process to the one utilised to determine ARO priorities. As with AROs, attractiveness was plotted against feasibility and programs were grouped according to high, medium or low priority.

Linking needs to priority programs and identifying training requirements

High priority research programs where R&D capacity is limited by skills, knowledge, and facilities were identified within each ARO, and investments in capacity development were linked to these programs. Based on the same principle, identifying the training needs was directed towards high priority research programs with low R&D capacity caused by limited skills. Advanced training needs were defined under three groups:

❏ *Training for Special Research Skills*
   This type of training applies especially to research staff who may not be eligible to undertake further academic studies, but who need special skills to contribute to a high priority research program.

❏ *Higher Degree (Postgraduate) Training*
   The product of this type training is a researcher with a broad science understanding, coupled with in-depth knowledge and skills in a particular research area, but with the flexibility to adapt the skills acquired to address new areas and problems.

❏ *Organisational and Management Training Requirements*
   Type of the training in areas such as program/project management, financial and personnel management systems and in knowledge, information and communication systems is conducted in tandem with technical research training for either researchers or research managers.

II – Results and discussion

1. Areas of research opportunities (AROs), research programs and their priorities
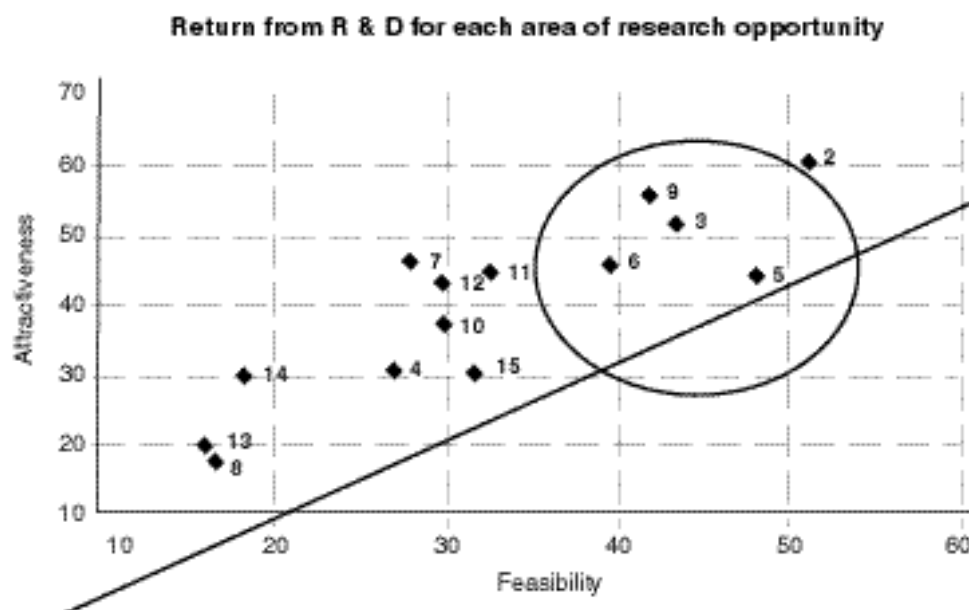
The 15 areas of research opportunities (AROs) were defined in the priority setting Workshop (Table 1). Later on, Poultry & fish, and apiculture & silk were separated; numbers of AROs became 17.

As shown in Figure 2, ***the basic relative priorities*** of 15 AROs were grouped under high, medium, and low priority classes. Six AROs - oilseeds, dairy and beef, industrial crops, cereals, fruits and vegetables - were assigned the highest relative scores for attractiveness and feasibility and represent the highest priority group of the 15 AROs investigated. Depending on the current level of their support, this high priority group should receive a greater proportion of the total resources.

Table 1. Current allocation of resources to AROs compared with the priority rating for the same AROs

ARO	Current %	Priority*
Cereals	21,0	H↓
Oil seeds & food legumes	7,0	H↑
Industrial crops	11,0	H↓
Nuts	2,0	M↑
Fruits	21,0	H↓
Vegetables (and ornamentals)	15,0	H↓
Processed food crops	< 1,0	M↑
Pharmaceuticals & agricultural Chemicals	6,0	L↓
Dairy and beef	5,0	H↑
Sheep	2,5	M↑
Feeds and forages	1,5	M↑
Poultry & fish	4,0	M o
Apiculture & silk	0,5	L↑
Processed animal products	< 1,0	L↑
Natural resource base	< 1,0	M↑

* **H** = Highest priority (strong emphasis); **M** = Medium priority (selective emphasis); and **L** = Low priority (limited support). Fish would rate higher than poultry and apiculture higher than silk, if the combined AROs (Poultry & Fish and Apiculture & Silk) were separated into separate AROs. ↓ Increased future emphasis, ↓ Decreased future emphasis, and **o** Little change in emphasis.

Figure 2. Grouping of attractiveness versus feasibility for all AROs to give return to Turkey from R&D. Priority groups High, Medium and Low are indicated

Return from R & D for each area of research opportunity

Legend
1=cereals; 2=oilseeds & food legumes; 3=industrial crops; 4=nuts; 5=fruits; 6=vegetables (ornamentals); 7=processed foods; 8=pharmaceuticals & agricultural chemicals; 9=dairy & beef; 10=sheep; 11=feeds & forages; 12=poultry & fish; 13=apiculture & silk; 14=processed animal products; 15=natural resource base. (As a result of the Workshop, separate ARO Role Statements were prepared for poultry, fish, apiculture and silk giving 17 AROs).

The second group of AROs - processed foods, feeds and forages, poultry and fish, sheep, nuts and natural resources - have intermediate scores which, in general, were judged to be relatively more attractive than feasible. Here, support should be more selective, with a need to improve their feasibility with additional training and by making efficiency gains in research delivery to ensure that the highest benefits possible are achieved from investment in this group.

The third group, pharmaceuticals and agricultural chemicals, apiculture and silk and processed animal products had relatively low scores and have been judged to be relatively the least attractive and feasible. Support for the AROs in the low priority group should be most selective.

If apiculture and fish had been defined as separate AROs, they would have been assigned higher relative priorities. Their scores were discounted by the participants by their pairing with lower priority areas of silk and poultry, respectively. The resource allocations made on the basis of the priorities set at the Workshop should reflect the distinction between these research areas.

Separate role statements are given for fish, poultry, apiculture and sericulture as the workshop concluded that the relative priorities of these would change significantly if they were separated.

AROs were grouped according to their relative priority and comparisons between current investment and investment required for future priority research were made. These comparisons showed that significant changes in relative investments in AROs were required in the future (Table 1).

85 research programs, that need to be addressed to achieve the desired research outcomes, were identified under the 17 AROs. The list of potential programs was an important output of the Workshop. However, there are not sufficient trained staff or resources in GDAR to work on all these research programs simultaneously, so the list is the point of departure for GDAR to establish priorities across these proposed programs. This will give the definitive set of priorities and programs in the 17 AROs for at least the next five years.

The AROs' goals, research programs under each ARO and their priorities, and training needs are as follows.

2. Cereals

Goal: To improve the quality of cereal grain and derived products, to raise the yield and efficiency of production, while maintaining the sustainability of the resource base over the range of production environments and cropping systems.

A. Research programs

High Priority Research Programs
❑ Improving the quality and productivity of durum wheat
❑ Improving the yield and quality of bread wheat

Medium Priority Research Programs
❑ Improving the yield and quality of barley
❑ Integrated management of sune pest in wheat
❑ Improvement in the production and adaptation of maize varieties and the control of major pests and pathogens

Low Priority Research Programs
❑ Development of sustainable production systems for high yielding rice varieties for irrigated areas including the Southeast region of Turkey.

B. Training needs	Types of training
High Priority Training Needs	
❑ Quality improvement of durum wheat	Masters
❑ Durum wheat improvement (ICARDA)	Short Term
❑ Breeding studies bread wheat	Short Term
High Priority Training Needs	
❑ Breeding for quality in barley	PhD
❑ Control of malting quality in barley	Short Term

❏ Integrated pest management (sune pest)   Short Term
❏ Control of corn borer in maize   PhD
❏ Pest management in maize (CIMMYT)   Short Term
❏ Study of new rice plant types (IRRI)   Short Term

3. Oil seeds and food legumes

Goal for oil seeds: To increase the productivity and international competitiveness of a range of cool season and summer oil seed crops, with higher grain and oil yields, favourable fatty acid balance and freedom from undesirable toxins, to satisfy the expanding domestic demand and to reduce imports of these products.

Goal for food legumes: To increase the productivity and international competitiveness of food legumes, in line with export demand, through further development of fallow cropping systems and improved stability of yield, grain type and quality, to access a wider range of export markets.

A. Research programs

High Priority Research Programs
❏ Improvement in the grain quality and productivity of lentils and chickpea
❏ Improving the production and productivity of sunflower

Medium Priority Research Programs
❏ Development of improved grain quality, yield and pest management in food legumes

Low Priority Research Programs
❏ Adaptation and development of oilseed crops for different agroecological zones

B. Training needs   Types of training

High Priority Training Needs
❏ Grain quality in pulse legumes   PhD
❏ Genetic resources for chickpea and lentils   Short Term
❏ Nutrition and water relations of sunflower   Masters
❏ Agronomy of sunflower   Short Term

Medium Priority Training Needs
❏ Adaptation of winter oilseed crops   Short Term
❏ Improvement of food legumes   Short Term

4. Industrial crops (cotton, maize, potato, tobacco, spices and medicinal plants)

Goal: To improve the yield and quality of industrial crops by the development of more efficient, profitable and sustainable production systems.

A. Research programs

High Priority Research Programs
❏ Improvement in production, lint yield and quality of cotton
❏ Integrated management of cotton pests
❏ Development of improved table potato
❏ Development of medicinal and aromatic crops

Medium-Low Priority Research Programs
❏ Improvement of soybean and it's role in cropping systems
❏ Improving the quality and diversity of tobacco leaf production

B. Training needs	**Types of training**

High Priority Training Needs

❏ Lint yield and fiber quality in cotton — PhD
❏ Cotton agronomy under irrigation — Short Term
❏ IPM in cotton - application in the field — Masters

Medium Priority Training Needs

❏ Potato (table) varieties and their uses — Short Term
❏ Oil extraction in aromatic plants — Short Term

Low Priority Training Needs

❏ Soybean varieties and role in cropping systems — Short Term

4. Vegetables and ornamentals

Goal: To develop technologies for more efficient and sustainable production of high quality vegetables (and ornamentals) meeting minimum residue standards, together with improved post-harvest storage technologies which will ensure farm-level profitability and international competitiveness of these industries.

A. Research programs

High Priority Research Programs

❏ Solanaceae research
❏ Protected vegetable production

Medium Priority Research Programs

❏ Leguminous vegetable research
❏ Cucurbitaceae research
❏ Root and bulb vegetable production
❏ Development of indigenous ornamental plants

Low Priority Research Programs

❏ Mushroom production and quality

B. Training needs	**Types of training**

High Priority Training Needs

❏ Tomato improvement — PhD
❏ New tomato varieties for domestic and industrial use — Short Term
❏ Controlling the environment for protected vegetable production — Masters
❏ Production technology for protected vegetable production — Short Term

Medium Priority Training Needs

❏ Pest management in food legumes — Short Term
❏ Intensive cucumber production — Short Term
❏ Hybrid onions - development of CMS lines — Masters
❏ Improvement of garlic — Short Term

Low Priority Training Needs

❏ Development of native ornamentals — Short Term
❏ Commercial mushroom cultivation (Turkey) — Short Term

5. Nuts

Goal: To improve the yield, quality and adaptation of the major nut species by exploiting the range of genetic variation and making it available, together with improved technology for establishment, production, post-harvest management and market analysis.

A. Research programs

High Priority Research Programs
❏ Pistachio research

Medium Priority Research Programs
❏ Hazelnut research

Low Priority Research Programs
❏ Research on other nuts

B. Training needs	Types of training
Medium Priority Training Needs	
❏ Periodicity of fruiting of nut trees	Masters
❏ Production of pistachios in California	Short term
❏ Quality issues in hazelnut	Short Term
Medium Priority Training Needs	
❏ Production, harvest and storage of almonds	Short Term

6. Fruits

Goal: To increase production potentials of high quality pure fruit which meet minimum residue standards with adequate shelf life and which ensure farm-level profitability and competitiveness on domestic and export markets.

A. Research programs

High Priority Research Programs
❏ Citrus research
❏ Stone fruit research

Medium Priority Research Programs
❏ Pome fruit research
❏ Viticulture research
❏ Fig research
❏ Olive research

Low Priority Research Programs
❏ Sub-tropical fruit research
❏ Berry fruit research

B. Training needs	Types of training
High Priority Training Needs	
❏ Dwarfing root stocks	Masters
❏ Ferdigation technology	Short Term
❏ Citrus roots stocks (virus free)	Short Term
❏ Citrus quality	Short Term
❏ Maturity time in stone fruit	Short Term
❏ Control of apple pests	Masters
❏ Variety development in apples	Short Term
Medium Priority Training Needs	
❏ Raisin production	Masters
❏ Table grape varieties and production	Short Term
❏ Productivity of olives	Short Term
❏ Quality control in dried figs	Short Term

Low Priority Training Needs
❏ Technology for production of berry fruit   Short Term
❏ Management of sub-tropical fruit in Mediterranean climate   Short Term

7. Processed food products

Goal: To develop new and higher quality crop food products for processing, to assist industry in resolving production problems, and to ensure the purity of these products for human consumption.

A. Research programs

High Medium Priority Research Programs
❏ Modifying crop products to improve processing
❏ Managing chemical residues in crop plants

B. Training needs	Types of training

Medium Priority Training Needs
❏ Peach varieties for processing   Short Term
❏ Requirements for vegetable processing in Turkey   Short Term
❏ Industry standards and export requirements for chemical residues   Short Term
❏ Evaluation of chemical residues in crops   Short Term

8. Pharmaceuticals and agricultural chemicals

Goal: To evaluate and improve the effectiveness and efficient use of pharmaceuticals, fertilizers, pesticides and herbicides to improve productivity and quality of food and food safety.

A. Research programs

High Priority Research Programs
❏ Improving the efficiency and effectiveness of fertilizers
❏ Improved efficacy of animal vaccines

Medium Priority Research Programs
❏ Nature and efficacy of pesticides and herbicides

Low Priority Research Programs
❏ Development of improved technology for vaccine and antiseptic disc production

B. Training needs	Types of training

High Priority Training Needs
❏ Evaluating Fertilizer Composition   Short Term
❏ Efficacy testing and improvement   Short Term

Medium Priority Training Needs
❏ Pesticide formulation and testing in Turkey   Short Term

9. Dairy and beef

Goal: To increase profitability and international competitiveness of meat, milk and hide production, through research on productivity, product quality, feed conversion efficiency and prevention, control and management of diseases of economic significance.

A. Research programs

High Priority Research Programs
- ❏ Economical feeding systems for cattle and improvement of feed quality
- ❏ Improved reproductive efficiency of dual purpose cattle in extensive and intensive production systems.
- ❏ Epidemiology of production diseases and improved diagnosis, prevention, control and management programs for diseases of cattle

Medium Priority Research Programs
- ❏ Improvement of dairy and beef cattle through selection and crossbreeding

Low Priority Research Programs
- ❏ Improved housing, mechanisation and herd management systems for intensively reared dairy and beef cattle
- ❏ Definition of productive performance (characterisation) of cattle managed under extensive and intensive farmer conditions

B. Training needs	Types of training
High Priority Training Needs	
❏ Applied Animal Nutrition	Masters
❏ Feed Management Planning	Short Term
❏ Feed Analysis Techniqu	Short Term
❏ Reproduction Management & Recording Systems	Short Term
❏ Livestock Production Analysis/ Economics	Masters
❏ Livestock Production Analysis/Economics	Short Term
Medium Priority Training Needs	
❏ Animal Genetics	PhD
❏ Milk and Beef Cattle Recording Systems	Short Term
Low Priority Training Needs	
❏ Diagnosis of Venereal & Virus Diseases	Short Term

10. Sheep and goats

Goal: To increase the profitability and international competitiveness of the sheep and goat industry (meat, milk, wool, mohair and hides) through research on improved nutrition, management, genotype, recording and selection techniques, reproductive efficiency, product quality characteristics and disease prevention, control and management.

A. Research programs

High Priority Research Programs
- ❏ Feed supply and demand and the impact of supplementary feeds, and feed quality, management and housing on sheep and goats in farmers flocks
- ❏ Improve the reproductive efficiency and productive capacity in village flocks

Medium Priority Research Programs
- ❏ Define the productive characteristics of important regional indigenous breeds of sheep and goats under farmer conditions
- ❏ Breed improvement through selection of indigenous breeds and crossbreeding programs in sheep and goats the major sheep producing regions of Turkey
- ❏ Epidemiology of production diseases and improved diagnosis, prevention, control and management programs for diseases of sheep and goats
- ❏ Lamb production systems and impact on carcass composition and meat quality

Low Priority Research Programs
- ❏ Improvement of yield and profitability of fiber production in sheep and goats

B. Training needs	Types of training
High Priority Training Needs	
❏ Applied Animal Nutrition	Masters
❏ Feed Management Planning	Short term
❏ Feed Analysis Techniques	Short term
❏ Animal Production Systems	Masters
❏ Reproductive Physiology	PhD or Masters
❏ On-Farm Recording Systems & Analysis	Short Term
❏ Livestock Production Analysis/Economics	Short Term
❏ Livestock Production Analysis/Economics	Masters
Medium Priority Training Needs	
❏ Animal Genetics	PhD
❏ Applied Animal Breeding	Masters
❏ Livestock Recording Systems	Short Term
Low Priority Training Needs	
❏ Fiber Measurement Techniques	Short Term
❏ Flock Health management	Short Term

11. Feed and Forages

Goal: To improve the quantity and quality of forage and fodder crop production systems throughout Turkey and to develop sustainable management systems for the establishment, rehabilitation and use of grass and legume pastures in range land environments.

A. Research programs

High Priority Research Programs
❏ Improved forage and fodder varieties for important environments in Turkey

Medium Priority Research Programs
❏ Development of pastures and meadow for rangeland environments
❏ Improved systems for utilizing manufactured feed concentrates, crop residues and by-products for livestock production

Low Priority Research Programs
❏ Improved feed conservation, storage and feeding systems of forage and fodder crops for livestock

B. Training needs	Types of training
High Priority Training Needs	
❏ Forage production in rangeland environments	Short Term
❏ Fodder production in Eastern Turkey (opportunities & constraints)	Short Term
Medium Priority Training Needs	
❏ Protection systems for rangeland pastures	Short Term
❏ Feed quality standards (including minerals and additives)	Short Term

12. Fisheries (marine and freshwater)

Goal: To develop sustainable management systems, and to improve the volumes of desirable fish species that are captured or harvested from Turkey's fresh and marine water sources.

A. Research programs

High Priority Research Programs
❏ Selection and husbandry of economically important species in coastal marine waters and in lagoons and inland waterways
❏ Improved diagnosis and management of diseases (both sea and freshwater fish).

Medium-Low Priority Research Programs
❏ Development of improved technology for fry production and husbandry

B. Training needs	**Types of training**
High Priority Training Needs	
❏ Introduction, demonstration and development of Bivalve Mollusca	Short Term
❏ Monitoring and management of marine biotoxins	Short Term
Medium Priority Training Needs	
❏ Product diversification (breams, turbot, sturgeon, grouper)	Short Term

13. Poultry

Goal: To collaborate with the private sector to improve the productivity, health and nutrition of the poultry industry.

A. Research programs

High Priority Research Programs
❏ Improvement of the economic performance of intensively reared broiler and egg production flocks

Medium Priority Research Programs
❏ Epidemiology of poultry production diseases in Turkey

Low Priority Research Programs
❏ Diagnosis, treatment and management of poultry diseases in intensive and extensively reared flocks.

B. Training needs	**Types of training**
High Priority Training Needs	
❏ Poultry Production Performance Analysis & Economics	Short Term

14. Apiculture

Goal: To improve profitability of production and processing of honey and other bee products, including improved seed set of crops requiring insect pollination.

A. Research programs

High Priority Research Programs
❏ Determination and breeding of indigenous genotypes and introduction of exotic races.
❏ Improved diagnosis, treatment and management of bee diseases

Medium Priority Research Programs
❏ Improvement of the quality and variety of hive products

Low Priority Research Programs
❏ Impact of improved pollination on crop yield and quality

B. Training needs	**Types of training**

High Priority Training Needs
❏ Genetics, Selection, Introduction   Masters
❏ Disease Diagnosis   Short Term

Medium Priority Training Needs
❏ Pollination Enhancement   Short Term

15. Sericulture

Goal: To improve profitability and competitiveness of silk production.

A. Research programs

High Priority Research Programs
❏ Improvement of yield and quality of cocoon and silk production
Low Priority Research Programs
❏ Diagnosis, treatment and management of silkworm diseases

B. Training needs	**Types of training**

Medium Priority Training Needs
❏ Study Tour - High Producing Sericulture Systems   Short Term

16. Processed animal products

Goal: To assist in achieving higher quality of processed and other value added animal products.

A. Research programs

High Priority Research Programs
❏ Development of new processed animal products

Medium Priority Research Programs
❏ Improved techniques for identification and quantification of chemical and anabolic residues in processed animal products and PSP/DSP toxins in processed marine and freshwater products

Low Priority Research Programs
❏ Improved management and use of by-products and wastes from processing of animal products

B. Training needs	**Types of training**

High Priority Training Needs
❏ New and improved processed dairy products   Short Term
❏ Techniques for analysis of chemical residues in meat and dairy products   Short Term

17. Natural resource base

Goal: To achieve greater bio-diversity through the conservation of plant and animal resources, and to develop more sustainable production systems through conservation and the management of soil, water and pests in cropping and rangeland grazing systems.

A. Research programs

High Priority Research Programs
❏ Plant bio-diversity and conservation

❏ Improved fisheries stock assessment and resource management of economically important marine and freshwater stocks

Medium Priority Research Programs
❏ Animal bio-diversity and conservation

Low Priority Research Programs
❏ Development of data base for resource data
❏ Range conservation and management

B. Training needs	**Types of training**
High Priority Training Need	
❏ Plant conservation and in situ preservation	Short Term
❏ Fisheries stock assessment methodology	Short Term
Medium Priority Training Needs	
❏ Identification of important animal genotypes and conservation options	Short Term
❏ Data base development and GIS systems	Short Term
Low Priority Training Needs	
❏ Forest grazing systems	Short Term

18. Research management

Goal: To develop agriculture research policy in terms of allocating resources to priority research programs and to provide leadership, opportunities for training, improved collaboration, communication and information systems along with development of personnel policies and research advocacy.

B. Training needs	**Types of training**
High Priority Training Need	
Research Management	
❏ ARMP implementation	Short Term
❏ Research Management System	Short Term
❏ Financial Management	Short Term
❏ Administration Study	Short Term
❏ Study Tour Research Management	Short Term
Computer Skills	
❏ Spreadsheets	Short Term
❏ Word Processing	Short Term
❏ Communication Systems	Short Term
Library & Communications	
❏ Library Systems	Short Term
❏ Library Data Access	Short Term
❏ Communication Systems	Short Term
Research Performance	
❏ Priority Research System	Short Term
❏ Project Preparation	Short Term
❏ Project Assessment	Short Term
❏ Project Budgeting	Short Term
❏ Report Writing Skills	Short Term
❏ Scientific Paper Writing Skills	Short Term
❏ Research Design & Analysis	Short Term
❏ Peer Reviews	Short Term
❏ Impact Studies	Short Term
❏ Adoption Studies	Short Term

III – Identifying training suppliers

Potential suppliers of training for GDAR's research activities are available in Turkey, or in institutions overseas and the choice between these will depend on the purpose of the training types and the quality of its opportunities required.

Training for special skills is available in Turkey at Universities and some special research institutions. For mid-career staff, who have little or no language skills, this is only opportunity for training. For those with foreign language skills, especially English, a wider range of opportunities exist overseas in Universities, international organisations and research institutions. Another option to obtain training is to import the special skills by contracting the services of specialists to run short courses.

Again as for skills training, *masters* and *doctoral degrees* are undertaken at universities in Turkey or at suitable universities overseas, provided age (under 35), language skills and financial resources are available. Considerable amount of staff in the research institutes have obtained masters and doctorates at universities in Turkey. They usually enroll as external candidates while working at one of the agricultural research institutes.

For those research staff who get the opportunity to attend an overseas university, it is tried to select institutions that have a high standard and provide the appropriate staff and training opportunities. The advantage of an English spoken university is that it reinforces the candidate's English spoken and reading skills, which provides the means to access to the bulk of the world's scientific literature.

Research managers are taken by GDAR to "Basic Course For Research Management". Additional training provided to specialised staff in areas such as program/project management, financial and personnel management systems and in knowledge, information and communication systems is conducted in tandem with technical research training. This type of training is implemented as either in-country or overseas.

For all kind training, the suitable venues in Turkey and overseas are obtained by contacting key international and national institutions, and individuals in the target countries and requesting the information on the names of institutions and the training opportunities they offer. In order to establish necessary scientific capacity, GDAR intensively uses its own resources and opportunities provided by international organisations. *Although, international institutions, especially the Centers of CGAR and C.I.H.E.A.M., pro -vide quite a bit training possibilities, GDAR only uses the ones matching to its needs*.

Summary and conclusions

The agriculture sector is very important for Turkey in the cases of total production, engagement of labour force and export earnings. The continuous challenge to the sector is to develop further and to meet the needs of both domestic and international markets into the next century. To be successful, Turkey's producers and processors must be competitive. *Innovation* and *technical improvement* by both groups will be fundamental to achieve this goal.

The special circumstances of agriculture in Turkey justify a much expanded public investment in agricultural research. *The great majority of the agricultural researches on crop, animal, food and aqua -culture are performed by the institutions of General Directorate of Agricultural Research* (GDAR) in the Ministry of Agriculture and Rural Affairs (MARA). At the beginning of 1990's, the research organisation of MARA was weak and needed to be strengthened. GDAR has prepared and implemented an *Agricultural Research Master Plan* (ARMP) in last four years, in order to *deliver the needed high quality and relevant research, and to obtain the return on the current public investment in research*.

Since solutions were needed for too many problems and the resources for research were not sufficient, defining of priorities was critical. Furthermore, agricultural research must compete successfully with other uses for public funds, so the products of research must have value to the economy. For those reasons, *agricultural research priorities were determined to achieve effective focus and to obtain the maxi - mum return on investment in research,* as a part of the ARMP.

17 Areas of Research Opportunities (AROs) were defined in general terms to account for the full range of research activities being undertaken by the research institutes, and output based and in most cases represented broad agricultural products. Each ARO was assessed as the return to Turkey from research and development, based on four independent scoring criteria, that are *potential benefits to Turkey of the ARO, Turkey's ability to capture these potential benefits, R&D potential in the ARO, and R&D capacity in regard to the ARO*. Scores for two indices, which are *attractiveness* and *feasibility*, for each ARO were derived from the scores for these four criteria. Attractiveness was calculated as the pro- duct of the *potential benefits to Turkey*, namely the maximum economic, social and environmental returns possible from technical improvement in the ARO, and *Turkey's ability to capture these bene - fits*, as measured by industry's ability to convert technical progress into commercial or other returns. *Feasibility* was calculated as the product of the technical potential of *relevant areas of R&D*, and the *current capacity to realise this R&D potential* and achieve the technology goals in an efficient and timely way. The *attractiveness* versus *feasibility* screen, depicts the *basic relative priorities* of 17 AROs. The AROs were grouped according to high, medium or low priority.

Comparisons between current investment and investment required for future priority research were made based on the basic relative priorities of AROs.

Potential programs were identified for each of the AROs. Priorities for programs were established by a similar process to the one utilized to determine ARO priorities. As with AROs, attractiveness was plotted against feasibility and programs were grouped according to high, medium or low priority*. 85 research programs, those need to be addressed to achieve the desired research outcomes, were identified under the 17 AROs*. However, resources in GDAR to work on all these research programs were inade- quate and *there were not sufficient trained staff*. So the list was the guide of departure for GDAR for preference of the proposed programs with high priority. Furthermore, training became urgent to establish critical scientific capacity in case of qualified staff needed for the programs with high attractiveness.

High priority research programs where R&D capacity is limited by skills, knowledge, and facilities were identified within each ARO, and investments in facility improvement were linked to these programs. Following the same procedure*, identifying of advanced training needs was directed towards high priority research programs with low R&D capacity caused by limited skills and knowledge*. The needs for advanced training were defined under three groups: (a) Training for special research skills, (b) higher degree (postgraduate) training, and (c) organisational and management training requirements.

Potential suppliers of training for GDAR's research activities are available in Turkey, or in institutions overseas including national, international and private ones. For all kind training, the suitable places in Turkey and overseas are obtained by contacting key international and national institutions, and indivi- duals in the target countries. In order to establish necessary scientific capacity, GDAR intensively uses its own resources and opportunities provided by international organisations.

Although international institutions, especially the Centers of CGAR and C.I.H.E.A.M., provide quite a bit training possibilities, GDAR is able only to use the ones matching to its needs. *Our expectation from this seminar is updating the training programs of C.I.H.E.A.M. institutes, by considering the mem - ber countries' needs. This will help that its program matches with the training needs of the Mediterranean Countries including Turkey's*.

Advanced training is a key factor for Turkey's agriculture sector, in order to improve ***output and quali - ty of research, to expand ability to address priority research programs and projects, and to access better to relevant skills and technology from abroad***. It is an ongoing activity in agricultural research, because of the dynamic nature of the field and the need to constantly upgrade the awareness and skills of the staff to the availability of new information and technology.

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