

INTERNATIONAL ATOMIC ENERGY AGENCY
AFRICAN REGIONAL CO-OPERATIVE AGREEMENT

REPORT

Final Review Meeting of AFRA Project II-17 (RAF/5/041)

***“DEVELOPMENT AND FIELD EVALUATION OF ANIMAL FEED
SUPPLEMENTATION PACKAGES”***

25-29 November 2000

Cairo, Egypt

FINAL REVIEW MEETING OF AFRA PROJECT II-17 (RAF/5/041)

“DEVELOPMENT AND FIELD EVALUATION OF ANIMAL FEED SUPPLEMENTATION PACKAGES”

25-29 November 2000

Cairo, Egypt

REPORT

1. Introduction and Background

The main objective of the AFRA Project II-17 (RAF/5/041) is the improvement of ruminant livestock production in AFRA Member States (MS). It had two main components: (a) the development and dissemination of cost-effective and sustainable feed supplementation packages which are based on locally available feed resources; and (b) establishment of the “Self-coating Radioimmunoassay” (ScRIA) technique for measuring progesterone in the milk and blood of ruminants.

The measurement of progesterone has been used within this project mainly for the assessment of ovarian activity in order to evaluate reproductive performance in animals that are subjected to different feed supplementation strategies. It was, however, realised that this technique has potential to monitor and improve existing support services to livestock farmers such as artificial insemination (AI) and to introduce new services such as early diagnosis of non-pregnancy and infertility. In order to ensure future sustainability of the RIA for use in such applications, the work on the second component has now been taken under a new project (RAF/5/046), and therefore was not the subject of discussion during the present meeting. The meeting dealt with the nutrition component: development and field evaluation of feed supplementation strategies.

The objectives of this meeting were to: (1) review the achievements in formulating and field testing including the economic analysis of feed supplementation strategies; (2) evaluate papers presented during the meeting from technical point of view for publication as an IAEA TECDOC, and (3) identify future areas of importance in the field of animal production for the AFRA region and develop a proposal for consideration by the AFRA to be undertaken by the AFRA MS during the cycle 2003-2004.

2. Final Review Meeting

The meeting was attended by 9 of the 10 nominated Project Co-ordinators (PCs) from 10 AFRA MS (Cameroon, Egypt, Madagascar, Mauritius, Nigeria, Sudan, Tunisia, U.R. Tanzania and

Zambia). The PC from Ghana did not attend the meeting. The meeting was supported by an IAEA expert (Dr. Noble Jayasuriya of Sri Lanka), the Project Scientific Consultant (PSC, Prof. Ibrahim Issa Ibrahim, also PC for Egypt) and the writer as IAEA Technical Officer.

The meeting was opened by Prof. A. Zahran, Chairman of Egyptian Atomic Energy Authority (EAEA). The opening ceremony was attended by a large number of distinguished invitees. The writer also delivered an address thanking the Government of Egypt and EAEA on behalf of the IAEA.

During the first two days each participant presented a report on the progress achieved. These were then discussed in depth and a SWOT analysis of the project was undertaken. The IAEA expert made a presentation on “Approaches cost-benefit analysis for the evaluation of supplementation packages”, and the writer in addition to directing the proceedings of the meeting, made two presentations: i) Recent advances in evaluation of feed resources, and ii) Future areas of importance in the field of animal production for developing countries and in particular the AFRA region.

The Agenda for the meeting is in Annex I and the list of participants is in Annex II. The achievements in the formulation and testing of feed supplementation packages including cost: benefit analysis and in the training of livestock personnel and farmers is summarised for each country in Annex III.

3. Conclusions

The major achievements and strengths are:

1. All MS that participated at this Final Review meeting have developed feed supplementation packages based on locally available feed resources and have completed on-station and on-farm studies (Cameroon, Egypt, Madagascar, Mauritius, Nigeria, Sudan, Tanzania, Tunisia, Zambia)
2. Most MS have established cost: benefit ratios for feeding supplementation packages (see achievements summarized in Annex III)
3. National training workshops to facilitate the development, field evaluation and extension of supplementation packages have been conducted by 90% of the participating MS.
4. A training manual on “Guidelines for developing feed supplementation packages” has been prepared and made available to all participating MS to assist in the development of feed supplementation packages and training of staff and livestock farmers.
5. A database on available feed resources and reproductive parameters of ruminant livestock has been completed by some participating countries.
6. Radioimmunoassay (RIA) facilities have been upgraded in the laboratories of all MS and self-coating RIA system has been established.

7. All MS have successfully participated in the external quality assurance programme for RIA.
8. RIA is now being routinely used in all participating MS for monitoring the reproductive performance of ruminant livestock under field situations.
9. Six Regional Training workshops have been completed as programmed.
 - Morocco, March 1997 - Training Workshop on “Guidelines for developing feed supplementation packages”
 - Ghana, April 1997 - Training workshop on “Methodologies and procedures for field testing of supplementation packages”.
 - Tunisia, May 1997 - Training workshop on “ Use of self-coating progesterone RIA kits”.
 - Zambia, November 1998 - External Quality Assurance for progesterone RIA”.
 - Egypt, October 1999 – Training workshop on “Iodination of Progesterone for RIA”.
 - Mauritius, May 2000 – Training workshop on “Standards and internal Quality Control for RIA”.
- 10 Effective communication has been established amongst PCs through Review meetings and scientific visits.
- 11 The developed technologies have been enhanced, consolidated and extended; linkages between collaborating institutions and national livestock systems have been further strengthened.

The main weaknesses have been:

1. Inadequate financial and logistical support from some National Governments for project activities
2. Lack of recognition and support for the role of the PSC, in spite of specific recommendations made at the first AFRA II-17 project co-ordinators meeting held in Tanzania in February 1997 and the second meeting in Madagascar in March 1999.
3. Problems associated with shipment and customs clearance for project materials, which have retarded progress in some MS.
4. Problems in nominations by MS as well as late notice to selected participants of training courses and workshops, leading to non-participation of some MS at these events.

The following opportunities were recognized:

1. There is increasing importance given to livestock production by most AFRA MS.
2. The possibility to improve local livestock production and thus reduce the high cost of imported milk and meat by offering improved technology and scientific advancement to the farmer.

3. The exchange of knowledge on livestock reproduction and nutrition between AFRA MS as well as increased linkages between the scientists, extension workers and farmers, leading to positive impact of scientific research on the end-user.

The following threats were identified:

1. Diminishing financial allocation for research by AFRA National Governments and diminished opportunities for funding by donors for livestock research.
2. Loss of trained personnel from the project.
3. Inability of sufficient farmers to financially support the sustainability of the RIA services in some AFRA MS.
4. Difficulties of travel and communication between AFRA MS.

4. Conclusions and Recommendations

Conclusions

Technical Aspects

1. All participating Member States (MS) have developed feed supplementation packages based on locally available feed resources and have completed on-station and on-farm studies.
2. Those MS who extended the packages to the farmers have been able to determine the cost effectiveness of the packages.
3. Six regional training workshops have been completed as programmed.
4. National workshops have been completed by 90 % of the participating MS.
5. A training Manual on “Guidelines for Development of Feed Supplementation Packages” was compiled and is available to AFRA MS.
6. A database on “ Feed Resources and Reproductive Parameters of Livestock” has been compiled by some participating MS.
7. Radioimmunoassay (RIA) facilities have been upgraded in all participating MS and the solid state RIA technique has been established.
8. All participating MS have successfully participated in the external quality assurance programme for RIA.
9. The project has lead to the successful co-operation between scientists from AFRA MS and the

willingness to plan together for the future.

Administrative and Logistical Aspects

1. The support provided by participating MS which hosted project meetings and workshops over the past 3 years is greatly appreciated.
2. Inadequate financial and logistical support was provided by the National Governments for project activities.
3. Inadequate recognition as well as no financial and logistical support was given to the PSC by the IAEA and AFRA Field Management Committee, in spite of specific recommendations made at the First AFRA II-17 Project Coordinators meeting held in Tanzania in February 1997 and the Second meeting held in Madagascar in February 1999.
4. Problems associated with shipment and customs clearance for project materials retarded progress in many participating MS.
5. Problems in nominations by MS as well as late notice given to selected participants of the training courses and workshops by IAEA lead to the non-participation of some MS at these events.

Recommendations

1. To Project Co-ordinators

1. All participating MS who have completed on-farm studies should ensure wider application and extension of the packages.
2. All Project Coordinators who successfully developed and tested supplementation packages should develop strategies for sustaining them by establishing suitable mechanisms such as establishment of a revolving fund system or entrusting the manufacture of the package to a private industry.
3. Where applicable Project Coordinators should incorporate the project activities into their national R&D programmes.

2. To AFRA National Coordinators

1. It is once again emphasized that in future programmes adequate administrative, logistical and financial support must be given to the PSC to carry out his/her functions effectively. This will further enhance the output of the programme.
2. Due to financial constraints of some participating MS, AFRA should provide funds for local expenses within AFRA projects when justified.

3. To AFRA Governments

1. All AFRA Governments should be urged to fulfill their commitments towards the implementation of AFRA Project activities.
2. The cooperation amongst the AFRA MS should continue and should be strengthened.
3. The project has come up with proven technologies. AFRA Governments should capitalize on this and support the extension of these packages and sustain them for the development of the livestock industries.

4. To IAEA

1. The artificial insemination and reproductive management component which was formulated as a sub-project of AFRA II-17 but subsequently approved by IAEA as a new AFRA Project (AFRA II-46), should be implemented in close collaboration with the Project Coordinators of AFRA II-17, utilizing the infrastructure and expertise which has been already established.
2. The participants of this project recognize that this programme will be terminated at the end of year 2000. However, in order that some of the activities continue until the initiation of a new programme at a later date, the IAEA should continue to assist the MS and provide facilities such as supply of RIA reagents, chemicals etc.
3. The papers presented at the meeting as well as those submitted to the IAEA but were not presented at this meeting and having substantial new information should be published as an IAEA TECDOC. The TECDOC should also be considered for placing on the AFRA web site.
4. The participating MS wish to propose a new project which will involve the use of non-conventional/lesser utilized feed resources for livestock production. It is strongly recommended that IAEA support be made available towards the formulation of the new project through a pre-project planning meeting in 2001 and any other pre-project training activities. The proposed project is entitled **'Improvement of livestock productivity through the enlargement of feed resource base and its effective utilization, using nuclear and related techniques'** (project justification is attached).

ANNEX I



AFRICAN REGIONAL CO-OPERATIVE AGREEMENT AFRA Project II-17 (RAF/5/041)

“Development and Field Evaluation of Animal Feed Supplementation Packages”

Final Review Meeting
25 – 30 November 2000
Cairo, Egypt

MEETING AGENDA

Saturday, 25 November

- | | |
|---|--|
| 09.30 - 10.30 | Welcome and Opening |
| 10.30 - 10.45 | Coffee/Tea |
| 10.45 - 11.05 | Setting the frame: Background, objectives, and expected outputs from the meeting - <i>Dr. Harinder Makkar</i> |
| 11.05 - 11.30 | A presentation on a recent topic in the area of Animal Production (title not yet received)- <i>Dr. Noble Jayasuriya</i> |
| Session I: Review of project activities and results obtained
<i>- Chairperson: Dr. Noble Jayasuriya</i> | |
| 11.30 - 12.00 | Enhancing the performance of cut-and-carry based dairy production in selected peri-urban areas in Tanzania through strategic feed supplementation - <i>Dr. B.M. Kessy (Tanzania)</i> |
| 12.00 – 12.30 | The economics of feeding concentrate to partially milked Sanga cows in a dry season - <i>Dr. P.K. Karikari (Ghana)</i> |
| 12.30 - 12.45 | Coffee/Tea |
| 12.45 – 13.15 | Response to dry season supplementation by dairy cows on the highland zones of Madagascar - <i>Dr. J.H. Rasambainarivo (Madagascar)</i> |

- 13.15 - 13.45 Mineral supplementation in the Tunisian small dairy farms - *Dr. J. Rekhis (Tunisia)*
- 13.45 - 14.30 Strategies for improvement of animal production in Egypt
- *Egyptian Scientist (Name not yet received; Prof. Ibrahim: please give the name and the exact title of the presentation)*
- 14.30 - 15.30 Lunch

Session II: Review of project activities and results obtained

- *Chairperson: Dr. I. I. Ibrahim*

- 15.30 - 16.00 The effect of using feed supplementation strategies on reproductive and productive performance of cows kept under transhumance system in tropical environment of Sudan - *Dr. Y.H. Elmansoury (Sudan)*
- 16.00 - 16.30 Development and field evaluation of animal feed supplementation packages for improving meat and milk production in ruminant livestock using locally available feed resources morocco - *Dr. B. Hulman (Mauritius)*
- 16.30 - 17.00 On-farm evaluation of the comparative growth performance of West African dwarf goat supplemented with *Calliandra calothyrsus*, *Leucaena leucocephala*, *Gliricidia sepium* or cotton seed cake in the Western highland of Cameroon – *Dr. E. Tedonkeng Pamo (Cameroon)*
- 17.00 - 17.30 General discussion

Sunday, 26 November

- 09.00 - 09.30 Recent advances in the evaluation of feed resources - *Dr. Harinder Makkar*

Session III: Review of project activities and results obtained

- *Chairperson: Dr. B. Hulman*

- 09.30 - 10.00 Use of poultry waste as a dietary supplement for ruminants - *Dr. I. I. Ibrahim (Egypt)*
- 10.00 – 10.30 Evaluation of Forage Legume *Lablab purpureus* as supplement for lactating Bunaji cows – *Dr. L.O. Eduvie (Nigeria)*
- 10.30 – 10.45 Coffee/Tea
- 10.45 – 11.15 Field evaluation of feed supplementation packages developed using locally available fed resources for improving milk production in Zambia – *Dr. N.J. Siulapwa (Zambia)*

Session IV: SWOT Analysis and Conclusions

- 11.15 - 12.30 SWOT Analysis
- Chairperson: Dr. L. O. Eduvie (assisted by Dr. Harinder Makkar)
- 12.30 - 12.45 Coffee/Tea
- 12.45 - 14.30 Summary of achievements and Conclusions
- Chairperson: Dr. I. I. Ibrahim (assisted by Dr. Noble Jayasuriya)
- 14.30 – 15.30 Lunch
- 15.30 – 17.00 **Future planning:** Where to after the completion of this project?
- Dr. Harinder Makkar

Monday, 27 November

- 07.30 - 15.00 **Field Visits**
- Visit to small and large farms
Visit to laboratories of the Atomic Energy Authority and the University

Tuesday, 28 November

Session V Editing of manuscripts for TECDOC

- 08.00 - 10.30 Editing of manuscripts
- 10.30 - 10.45 Coffee/Tea
- 10.45 - 12.30 Editing of manuscripts (continued)
- 12.30 - 12.45 Coffee/Tea
- 12.45 - 15.00 Editing of manuscripts (continued)
- 15.00 – 15.15 Return to Hotel
- 15.15 – 17.00 Lunch/Drafting of Recommendations (continued in Hotel)

Wednesday, 29 November

- | | |
|---|---|
| 08.00 - 14.00
(Coffee/Tea and
timings as on 28
November) | Editing of manuscripts (continued) and Finalisation of Recommendations |
| 14.00 - 14.30 | Presentation of Conclusions and Recommendations and general discussion on
Conclusions and Recommendations
<i>- Dr. Noble Jayasuriya</i> |
| 14.30 – 15.00 | Closure of meeting |

ANNEX II

IAEA/AFRA Regional Technical Co-operation Project II-17 (RAF/5/041)
“DEVELOPMENT AND FIELD EVALUATION OF ANIMAL FEED
SUPPLEMENTATION PACKAGES”
LIST OF PARTICIPANTS FROM AFRA MS

	Name	Institution	Address
1	Dr. Etienne Pamo	Faculte d'Agronomie Department de Production Animales Universite de Dschang	B.P. 222 Dschang CAMEROON Tel: 00237451381 00237451202 Fax: 00237451202 00237451381
2	Prof. Ibrahim Issa Ibrahim	Chairman, Radioisotope Applications Division Project Scientific Consultant (PSC) Egyptian Atomic Energy Authority	P.O. Box 13759, Cairo EGYPT Tel. : 202-3834287 Mobile : 012-218 7914 Fax : 002023834740 Email: elmougy@hotmail.com
3	Prof. Jhon H. Rasambainarivo	FOFIFA/DRZV	B.P. 4, Antananarivo MADAGASCAR Fax : 261-20-22 40270 Email : jrasamb@syfed.refer.mg
4	Dr. Beedeeanan Hulman	Assist. Director Livestock Agricultural Research and Extension Unit, Food and Agricultural Research Council	Newry Complex St Jean Road, Quatre Bornes MAURITIUS Tel.: 230-4663885 Fax : 230-4648809 Email : areu@bow.intnet.mu
5	Prof. Lawrence O. Eduvie	National Animal Prod. Research Institute Ahmadu Bello University	P.M.B. 1096, Shika, Zaria NIGERIA Fax: 0023469552272 00234062550737 Email: eduvie@abu.edu.ng napri@inet-global.com
6	Prof. Beda M. Kessy	Department of Vet. Surgery, Obstet and Reprod. Faculty of Veterinary Medicine Sokoine University of Agriculture	P.O. Box 3020, Morogoro UNITED REPUBLIC OF TANZANIA Tel.: 00255232603177 Fax: 00255232604647 Email: kessy@suanet.ac.tz
7	Dr. Nathan J. Siulapwa	Biomedical Sciences Department Animal Feed Supplementation Packages	P.O. Box 32379, Lusaka ZAMBIA Tel. : 260-1-293727 x 3063

		The University of Zambia	<i>Fax: 002601293727</i> <i>002601291508</i> <i>002601253952</i> Email: NSiulapwa@vet.unza.zm
8	Dr. Jamel Rekhis	École Nationale de Médecine Vétérinaire	2020 Sidi Thabet, Tunis TUNISIA <i>Fax: 216-1-552 441</i>
9	Dr. Y.H. Elmansoury	Department of Radioisotopes Central Veterinary Research Laboratories	P.O. Box 8067 (Alamarat) Khartoum SUDAN <i>Fax: 249-11-786563</i> E-mail: cvrl@sudatel.net nassu_9@hotmail.com

ANNEX III

AFRA II-17 (RAF/5/041) - Review of Achievements - Development and Testing of Feed Supplementation packages

	CAM	EGY	MAG	MAR	NIR	SUD	TUN	URT	ZAM
Type of supplement	Legume leaves +	Poultry litter	UMMB and other ¹	UMMB	Fodder Legume ++	Poultry manure /molasses mix, Molasses	Mineral block +++	UMMB, FC ++++	UMMB
Units of supplements made	-	8 tons	UMMB 4.5 tons	10000 kg	-	60 tons PM/UMMB/molasses	5000 kg	5000 kg	2700 kg
No. of farmers currently using supplement(s)	NA	30	270	100	30	75	23	56	7
No. of locations in the country	3	5	2	4	1 zone	2	10	2	2
No. of animals currently fed the supplement	-	100	For cattle 36 (UMMB)	100	180	500	190	64	210
■ Cattle/buffaloes	70	100	350	100	-	-	-	-	-
■ Goats/sheep	-	-	(other)	1000 deer	-	-	-	-	-
■ Other	-	-							
No. of training activities conducted									
■ Farmers	-	5	18	6	10	10	5	1	-
■ Extension	-	2	12	2	-	5	2	1	1

workers									
No. of man days of training provided									
■ Farmers	-	120	180	180	50	17	150	364	5
■ extension workers	-	20	60	24	-	10	6	12	112
Production responses (average increase)									
■ milk (L/animal/day)	-	Substitute	4 (2-8)	1	1.4	2-3	1 milk (20% increase in fat)	1.5	1.6
■ growth (g/animal/day)	20		200	-	400	-	-*	-	-
■ Other									
Cost of supplement fed/day		?	MGF 600	MRs.2.50	?	LS 150	TD 0.03	TS 182	ZK 570
Selling price of									
-2 milk (L)	CFA 400(US\$ 0.527)	LE 1.5(US\$0.4)	MGF 3000 (US\$ 0.45)	Rs 9.00 (US\$0.32)	N 10 (US\$ 0.09)	LS 1000(US\$ 3.88)	TD 0.65 (US\$ 0.431)	T S 275(US\$ 0.34)	ZK 800 (US\$ 0.22)
-3 meat (kg)	CFA 1500(US\$ 1.977)	LE 15-20 (US\$ 4-5.33)	MGF 12000 (US\$ 1.81)	Rs 80-120 (US\$ 2.92-US\$4.39)	N 120 (US\$ 1.12)	LS 5000 (US\$ 19.44)	TD 8 (US\$ 5.57)	T S 1000 (US\$ 1.259)	ZK 2000 (US\$ 0.563)
Cost:benefit ratio									
■ milk	45% increase in income	-	1:4-5	1:1.5	1:2	1:4	10 % increase in income	1:2	NA
■ meat		-	-	-	-	-		-	
■ reduction in cost of feed		10%	-	-	-	50%		-	

¹ fodder radish, concentrate and ground nut cake; * 38 days reduction in calving interval;

+ leucaena, calliandra, sesbania, cotton seed cake; ++ Lablab; +++ Di calcium phosphate; ++++ Farm made concentrate

Exchange rate for 1 US\$ according to the UN exchange rate in different currencies – 1 December 2000

Cameron = CFA 758.352

Egypt = LE 3.75

Madagascar = MGF = 6607.64

Mauritius = MUR 27.318

Nigeria = NGN 106.5

Sudan = SDD 257.2

Tunisia = TND 1.436

United Republic of Tanzania = TZS 794

Zambia = ZMK 3550

Improvement of livestock productivity through the enlargement of feed resource base and its effective utilization, using nuclear and related techniques

1. Problems, Needs and Opportunities

Livestock farming is crucially important for the countries in the AFRA region for provision of animal based food products for the population, and as a source of income for many poor farmers. However, the productivity of the livestock in most of the countries in the region is much below the potential productivity. The main constraint to livestock development in developing countries is the scarcity and fluctuation of the quality and quantity of the year-around animal feed supply.

Technologies that can be used to partially overcome these problems have already been developed through earlier AFRA project (RAF/5/041: Development of Feed Supplementation Packages) of the IAEA. Several countries in the region are already using some of these technologies. The proposed project envisages a strategy for introduction of these newly developed practices on a wider scale in the AFRA region through establishment of pilot farms to demonstrate these technologies and to train technical personnel, extension workers on these technologies. A technology, which has been developed during the last phase and has been found to be highly beneficial to farmers, needs to be highlighted and that the urea-molasses multinutrient blocks. The strong knowledge base existing in the participating MS, both with farmers and scientists, will be utilized in the proposed project to use these blocks as a carrier for: i) anti-helmenthic agents to control endo-parasites, and ii) feed additives of plant origin to increase efficiency of rumen fermentation, both of which will enhance animal productivity. The emphasis will be on the use of these agents or feed additives which are locally available, cheap and possibly of plant origin.

It was realized by the participating groups in the RAF/5/041 that in addition to the strategies applied earlier by this group and also by other groups in developing countries, novel approaches are required to bridge the gap between supply and demand of feeds. There is a serious shortage in animal feeds of the conventional types such as soyabean, cotton seed and groundnut meals, etc. In addition, the human population is increasing at a high rate and the arable land is decreasing due to urbanization and industrialization. The grains are mostly used for human consumption. The project, therefore, will identify and evaluate new or lesser known seed-bearing or fodder producing plants and trees capable of growing in poor, marginal and degraded soils that will make it possible to obtain low cost animal feeds which do not compete with human food.

2. The Approach and Method

Ten to thirty pilot farms will be established under the project to apply the proven supplementation packages for better nutrition and to extend the technologies to a wider number

of farmers and to realize a higher impact. Strategies such as establishment of revolving funds and making private industry a partner in development will be applied to sustain the technologies, wherever applicable. The integration of proper farm management strategies including effective use of records and cost-benefit analysis will be used in the pilot farms.

The pilot farms will also engage in evaluating the suitability of feed supplementation packages based on agroforestry systems (seed-bearing or fodder producing plants and trees capable of growing on poor soils) and agroindustrial byproducts, and of feeding the blocks containing anti-helmenthic agents and feed additives.

3. Expected Outputs of the Project

- Pilot farms with facilities and personnel to use supplementation strategies developed during the last AFRA project and the proposed project.
- Identification and use of cheap, locally available and safe anti-helmenthic agents and feed additives.
- Identification, propagation and use of lesser known, under utilized and unconventional feed sources of low cost animal feeds.
- Enhanced: i) regional capability for analyzing locally available feed resources and developing feeding strategies using recently developed nuclear- and biotechnology-based feed evaluation approaches, ii) co-operation and interaction between scientists from AFRA MS, and iii) linkages between scientists and farmers, farmers organisations, development agencies and NGOs. Spill-over effect of these will be higher quality of students graduating from the AFRA countries, better overall scientific and industrial base and better future of these countries.
- Availability of a database on lesser-known, under utilized and unconventional feed resources but adapted to the region (drought resistant, can be grown on marginal and degraded soils) to assist farmers and the livestock industry in their effective utilization.

4. End-Users

The livestock extension services, farmer co-operatives, development agencies and owners of the pilot farms. The final beneficiaries will be wider communities of livestock farmers.

5. Overall Development Objective

The improvement of the livestock productivity in AFRA region.

6. Specific Development Objectives

- The promotion of the use of the supplementation strategies developed and proven under the previous projects, in participating countries through establishment of pilot farms.
- Identification and use of cheap, locally available and safe anti-helmenthic agents and feed additives.
- Identification, evaluation of the suitability and subsequent use of lesser known and under utilized seed bearing or fodder producing plants or unconventional feeds as a source of low cost animal feed. The focus will be on those feed resources which do not compete with human food and can grow on poor, marginal and degraded soils.
- Establishment of regional capability for analyzing locally available feed resources and developing feeding strategies using recently developed nuclear- and biotechnology-based feed evaluation approaches.
- Generation of a database on feeding quality of lesser-known, under utilized and unconventional feed resources of the AFRA region

7. Role of Nuclear Technology

15-N, 16sRNA, purine, and 125-I based nuclear and biotechnology techniques for the *in vitro* evaluation of new types of low cost feed supplements, and urinary purine derivative approach (developed and validated using radio isotopes) for their *in vivo* evaluation.

8. Performance Indicators

- The number of pilot farms established.
- The decrease in the cost of production of meat and milk in the pilot farms as a result of adopting new strategies.
- The reduction in the cost of production of meat and milk on a national basis and increase in the utilization of marginal and degraded soil and their conversion to relatively fertile soil (over a specified period of time after the completion of the project).
- The number of new types of plants and other new sources found to be suitable sources of low cost animal feed.
- Number of laboratories using newly developed feed evaluation approaches, and number of laboratories which can provide training on these techniques to other laboratories in AFRA region.

9 Assumptions

- The pilot farms will be successfully established in the participating Member States (a rapid rural appraisal will minimise this risk).
- The adaptive research on evaluating new types of plants as suitable sources of animal fodder, anti-helmenthic agents and feed additives will be successfully completed. And facilities and personnel will be available to complete this work (nomination of well qualified, motivated and committed groups and laboratories equipped with basic facilities will minimise this risk).
- The new strategies developed will be adopted by livestock farmers (farmers participation from the very beginning of the project, a strategy proposed to be adopted in the programme, will minimize this risk) .
- The new sources of low cost animal feed identified through the project will be used by the farmers (farmers participation in the project will minimize this risk).

10. Commitments of the Member States

The Member States will undertake to provide cash contributions, facilities, equipment, and personnel and hosting of meetings and training programmes.