TRAINING AND EXTENSION FOR STORAGE IMPROVEMENTS THROUGH THE ESTABLISHMENT OF SPECIAL TECHNICAL UNITS

by
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Abstract

The role of such units in several tropical countries is reviewed on the basis of actual experience gained by the TDRI Storage Department, or its precursor the Tropical Stored Products Centre, through long-term involvements in the period 1960-1980. An ideal role is described and discussed in relation to the known practical achievements of these units and the reasons for their relative success or failure. The part that can be played by local research institutes, with special support, in the promotion of storage research and allied training is also indicated.

Special attention is drawn to the probable need for further long-term technical inputs by well-established and broadly experienced organisations of the developed countries. These should certainly continue to work, wherever possible, in close in-country collaboration with local crop storage units; thereby to support and assist the further development of such units, while also contributing directly and immediately to the effective implementation of the technological improvements that are already available but which often require close and careful adaptive research before they can be realised in practice. An account of some recent inputs of this kind, by TDRI, is referred to.

Introduction

The establishment of special Stored Products Units in tropical developing countries, to extend existing technology to durable crop storage situations in the tropics and to provide focal points for allied training programmes, has received considerable support and active encouragement from international aid sources over the past 25 years. In the period before 1960 and for some time afterwards, British technical assistance was given mainly to the former British Empire territories in the tropics and sub-tropics; especially those that were approaching independent status. At the present time the attention is more widely dispersed in accordance with Britain's expanded technical cooperation programme.

The present staff of the TDRI (formerly TPI) Storage Department at Slough includes a number of men who have been instrumental in this particular area of technical cooperation. Several of them were also on the staff of its precursor, the Tropical Stored Products Centre, which became the TPI Storage Department in the late 1960's. Much of the early work, between about 1955 and 1965, was accomplished under the aegis of the "TSPC", which developed from an overseas liaison unit attached originally to the Agricultural Research Council's Pest

Infestation Laboratory at Slough. That Laboratory, now known as the Slough Laboratory of the MAFF Agricultural Science Service, has for long been recognised as a centre of excellence for fundamental work on the biology and control of stored product pests; including work on grain biology and also on the physics and chemistry of grain storage and the chemistry and mode of action of insecticides.

Thus, the present TDRI Storage Department, which still shares the same site at Slough with the MAFF Laboratory, has not only a long history of staff experience in tropical stored products work but also a long and continuing relationship with its "mother laboratory" at Slough. From these two elements the Department derives a breadth of experience and a degree of expertise that gives it a unique position in stored products work world-wide. In addition, it has also the extensive in-house experience of its *alma mater* (TDRI) to draw upon in other related areas of post-harvest technology and pre-harvest pest management.

Particular Overseas Developments

The special stored products units with which we are particularly concerned in this paper are those that were set up in or around the period 1960-1980 and from which the expatriate input has been largely or wholly withdrawn. The withdrawal has generally taken place at a time when the Unit was seen to be reasonably or potentially self-sufficient. The precise timing has sometimes been influenced by other factors but it remains true that most of these Units were considered, for one reason or another, to have reached the point at which they should be left to "stand on their own feet". Nevertheless, the resources of the TDRI Storage Department have remained available to the trained staff of the Units through the opportunities provided by TDRI's various technical services, including its home-based training programme. Training opportunities have been substantially utilised, both by former "counterparts", for further training at Slough or at appropriate allied British universities, and also by other staff recruited subsequent to the original expatriate involvement. Technical advisory services have been less well utilised. It is probably true that the bulk of our extensive advisory work at Slough relates either to situations where we have one of our own staff in-post or to situations in which we have had no prior involvement. This pattern of requests for advice might be construed as indicating that the Units which we have helped to establish are so completely self-sufficient that our technical advice is very rarely needed. However, our occasional contacts with former counterparts and their younger colleagues, either at the Slough training courses or on overseas visits, lead us to conclude that this is not the case. It appears more likely, in many instances if not all, that there is an in-built reluctance to seek technical advice through overt formal channels. This reluctance may stem largely from a desire to appear self-sufficient or, at least, to appear not manifestly incapable of dealing with the problems for which the person concerned is supposed to have been trained. It is exacerbated, not reduced, by lack of actual experience.

In all fairness it must be pointed out here that the probable need for further technical support to assist a relatively inexperienced person is not peculiar to our colleagues in developing countries. Many of our own staff at Slough will have had the experience of being put "to stand on one's own feet" after a period of intensive training. Many of us can recall that the occasional provision of a more experienced worker, to help in the assessment of progress and the planning of further programmes, was not only welcome but often essential to the eventual success of our early work. However, the reluctance to demonstrate ones needs, through correspondence seeking additional advice, may be rather more specific to the young nationals of developing countries than to young, relatively inexperienced expatriates working in comparable situations. If so, the reason may be that the obvious source of additional support, in the first case, is foreign and external to the worker's own organisation; whereas in our case it would be a part of that organisation or, at least, a closely linked source. It is also possible that the young trained worker in a developing country is expected to be more self-sufficient .

Table 1 illustrates some of the recurrent factors that affect, in our experience, the development of a Stored Products Unit after the withdrawal of on-the-ground expatriate support. Detailed appraisal of the present status of these eight units has not yet been possible but it is hoped that opportunities for this may arise with some if not all of them. However, we do know that all eight are still in existence and functional to a degree. Moreover, we know that two of the earliest establishments remain, after some 20 years of operation, at least up to their original manpower level and are reputedly fulfilling a valuable function. Assessments such as those indicated in Table 1 are clearly very subjective. However, they are based upon the impressions held by various experienced workers and the regular occurrence of certain impressions is the notable point.

The "Trained Man" Fallacy

Several of the factors highlighted in Table 1 relate to the common fallacy, which in all probability no-one truly believes, that a person can be trained to do a job and then left to get on with it, entirely by himself, with great expectations of success. Eventual success may be the outcome, after a long and sometimes wasteful period during which the person develops his own experience. Such experience is gained "the hard way" and, while it may be true that some such endeavour is beneficial and even essential, it is somewhat illogical to commit people to a protracted period of possible isolation in their work if there is any chance of providing occasional support to encourage and, where necessary, to redirect their endeavours.

Conventional training can never provide more than an understanding of principles and an awareness of the possibilities for the solution of real problems. Even initial "counterparting" collaboration cannot be expected to steer sufficiently the development of experience unless it is protracted over a very long period or, perhaps better still, provided for a reasonable first period and then re-provided, at intervals, when necessary. Such further provisions may be called for by those who need them, but our experience shows that this does not

Table 1

OBSERVED RECURRENCE OF COMMON FACTORS AFFECTING LONG-TERM CAPABILITY IN EIGHT PARTICULAR CASES

Possible common factors	Particular cases							
	1	2	3	4	5	6	7	8
Terms of reference								
- Narrow (limited objectives)		✓		✓				✓
- Broad (extensive objectives)			✓		✓		✓	
- Intermediate	✓					✓		
Status when "handed over"								
- Considered to be sufficiently sound	✓	✓	✓	✓	✓	✓	✓	
- Considered doubtful								✓
Subsequent impediments								
Shortage of funds	✓		✓	✓	✓	✓	✓	✓
Non-replacement of staff	?		✓				?	?
Insufficient training								
Insufficient experience								
- In developing the work	?	?	?	?	?	✓		✓
- In providing effective technical guidance to management	✓		✓	✓	✓	?	✓	✓
Lack of general motivation (Insufficient support from higher management)					?			
Lack of clear incentives (Eg absence of satisfactory career structure)					?			

always happen. There is a clear need for a planned strategy, wherever and whenever such an approach is possible. Our immediate proposition is that possibilities for longer-term development strategies should now be more actively explored.

The Preconceived Role of Stored Products Units

In general terms the concept of establishing Stored Products Units in tropical countries relates to a perceived need for the introduction and implementation of improved storage technology. The general objective is to prevent or reduce losses of agricultural produce in countries where such losses can be very substantial if the available technology is inadequate to deal with storage problems, especially grain drying and pest control. For practical and technically defensible reasons the first target area has generally been the centralised storage facilities of produce marketing organisations. The general tendency for such organisations to expand and develop their facilities means, in practice, that customary storage procedures are unlikely to remain adequate. The risks and, sometimes, the realities of major storage losses therefore tend to increase and the need for technological development, with technical assistance where necessary, is not only apparent but also usually feasible.

The question whether or not it would be of greater economic importance to direct attention to on-farm storage and to dispersed storage by small traders is to some extent purely academic. There is no doubt that these sectors, in most tropical developing countries, represent the major quantity (some 75-85%) of national storage capacity. However, they also represent areas of great inaccessibility, not only logistically but also sociologically or politically. Moreover, it has commonly been assumed that domestic on-farm storage, which constitutes the main bulk of the 75-85% stored independently of centralised organisations, may well be reasonably efficient in the circumstances and at least moderately well adapted to those circumstances. The validity of this assumption has now been demonstrated in several cases. (See, for example, Fazlul Huq, 1980; Golob, 1981(a) & (b)). Even where the measurable losses are more significant (See Boxall *et al*, 1979 and De Lima, 1979) there remains a doubt, not always expressed, as to whether or not a general reduction of the losses is feasible in practice. Subsequent efforts to achieve reductions have often proved unsuccessful.

Nevertheless, any technological input on crop storage in a developing country should, obviously, give some attention to the problems of on-farm storage and trader storage. Such attention has often been given, to a greater or lesser extent depending upon practical circumstances as assessed at the time. In general, the outcome has been a recognition of the fact that there is relatively little to be done, for traditional on-farm storage, in the absence of any major and nationally concerted drive to develop farm level operations as a whole. Where there are such campaigns, and especially where they entail the introduction of high-yielding grain varieties that are commonly more susceptible to insect damage (Golob, 1981a), there is a definite need for inputs on storage. The local Stored

Products Unit, when one exists, should be poised to deal with these problems and should be given the capacity to provide the inputs. Such responsive "action-on-demand" will also be needed on the rare but not unknown occasions when a new pest appears on the scene, as has happened recently in Tanzania (Hodges, 1982). Attempts to improve storage by independent traders are even more speculative. Unless there are strong national incentives there is little that can be done; except by very slow and gradual demonstration of possible benefits to those who are prepared to accept an economic argument that goes beyond short-term financial gain. Nevertheless, here again there is need for a local Unit to have the potential capacity to respond to any developments that may increase the likelihood of real progress.

It is essential that a Stored Products Unit should be concerned with storage management in all its various aspects (see Figure 1) and, potentially, at all levels in the post-harvest system. In our own experience, such Units have generally been established with these comprehensive terms of reference or, at least, with intermediate terms of reference that allowed for the essential broadening. (See again, Table 1). In a few cases the initial objectives were limited and sometimes have remained so, being concerned either with farm level storage improvements alone, where other storage systems were ostensibly better catered for, or with the storage and quality control operations of a single major produce marketing organisation. It is possible that a Unit with limited objectives may be more likely to succeed in practice and our experience tends to confirm this. Nevertheless, in the long-term there is a general case for the establishment of Units with broad terms of reference, provided that these are developed and applied sysematically and rationally over a sufficient period of time and that the capability of the Unit, in all respects, is increased as necessary.

A further synopsis of the capabilities that may be required of a Stored Products Unit is given in Table 2. These required capabilities relate potentially to all levels in the post-harvest system and the Unit's ultimate effectiveness will depend upon the provision of adequate initial resources together with continuing technical development and financial support. These should be provided, where necessary and as far as possible, from expatriate sources. At an earlier point in this paper we have touched upon the distinction between economic motives and short-term financial incentives. Losses of quality and quantity in stored foodstuffs are economic losses of special importance in the modern world. They do not necessarily constitute financial losses in commerce. One of the salient and most insurmountable problems in the business of preventing or reducing such losses is that they are commonly unimportant to the skilful and experienced trader and may even be turned to his financial advantage. This makes it essential that there should be true economic motivation for all efforts to improve food storage systems.

It is fully understood and accepted that financial benefits can often be identified and demonstrated. Clearly, this should be done wherever it is possible. However, it is equally clear that such benefits cannot always be made manifest in customary practice. Wherever national aspirations towards better living standards are given effective utterance it should be the case that financial and economic incentives will merge. Nevertheless, it seems to us that

Fig. 1

SYSTEMATIC STORAGE MANAGEMENT

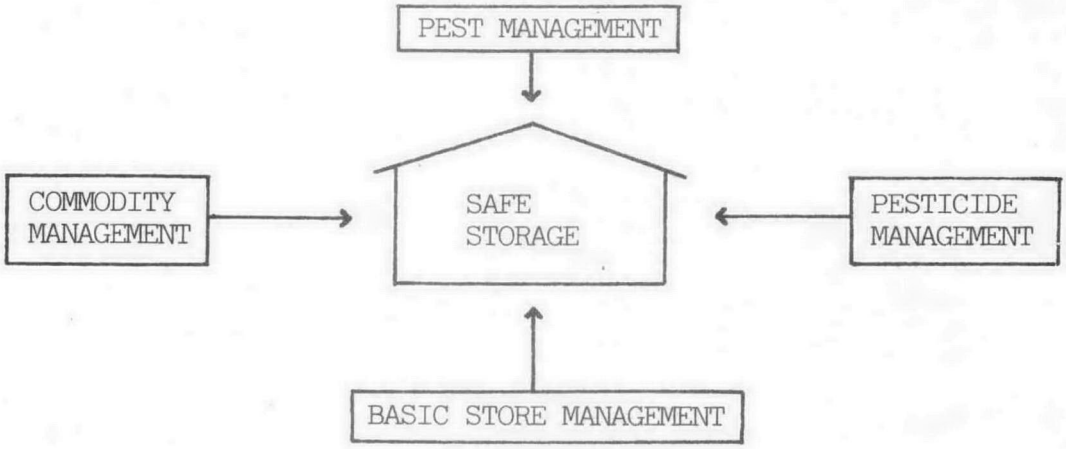
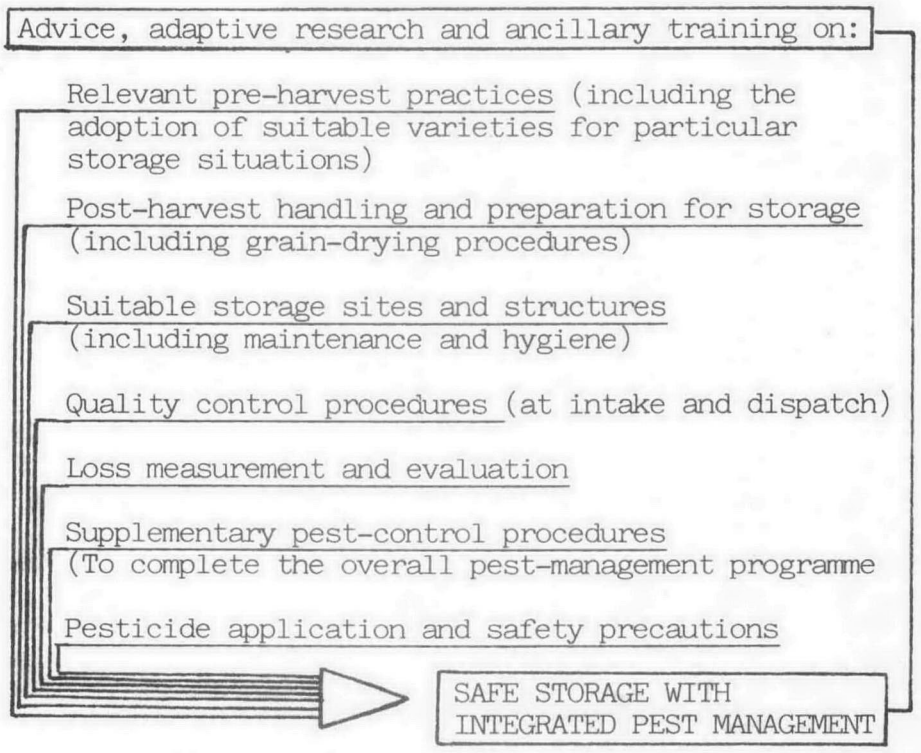


Table 2

CAPABILITIES EXPECTED FROM A FULLY EFFECTIVE S.P. UNIT



many developing countries may be some way from this point. Since it is in the general interest of the world community to prevent or reduce the loss of staple foodstuffs then a good deal of substantial further support, through international technical assistance arrangements, appears to be appropriate for the effective development of stored products work in developing countries. In particular, where established Units exist, with potential capability for the extension of storage improvements, then those Units should be given further support to assist the realisation of those capabilities. Our experience suggests that the required support should go beyond that which has been possible so far. Further training, locally or overseas, is not enough. There are particular and evident needs (see Table 1) for more financial support and, in some cases, for further regular technical inputs by experienced storage scientists. These are especially necessary, in collaboration with local technical staff, where management-level action is essential to the effective implementation of improvements. (Hindmarsh and McFarlane, in press). The apparently common "shortage of funds" may also be linked with lack of experience in dealing with higher management and it is not assumed that additional external funding is always necessary. Nevertheless, there may often be such a need, which may remain undefined in the absence of experienced assistance.

The Ideal Role of a Stored Products Unit and its Administrative Location

The ideal role would be one derived from the following general, basic terms of reference. For particular purposes, this outline would need to be amplified, where necessary, to identify specific objectives.

(i) To provide a local source of reliable information and advice on stored products pest management and all allied aspects of storage management; with eventual application at all levels.

(ii) To carry out relevant (often *ad hoc*) applied research in this area; generally adaptive research but more fundamental research included if relevant and not effectively catered for elsewhere.

(iii) To initiate and maintain relevant local training programmes and extension work (at all levels); where possible in association with any existing local institutions concerned with, or potentially responsible for, national developments in crop production or stored products management and conservation.

The desirable time-scale and a logical programme for the establishment and further development of such a Unit are outlined in Table 3.

The ideal administrative location of a Unit with such terms of reference can clearly be decided only in relation to particular circumstances, including any limitations or other specifications put into the initial terms of reference. Generally, however, a realistic

Table 3

A PROGRAMME AND TIME-SCALE FOR ESTABLISHING AN S.P. UNIT

Phase	Period	Years of operation
1. Initial establishment**!!	4 years	0 - 4
2. Technical autonomy (1st trial period)	4 "	4 - 8
3. 1st major review*	2 - 3 months	8
4. Expansion and/or reorientation **!!	2 years	8 - 10
5. Technical autonomy (2nd trial period)	5 - 10 years	10 - 15 or 20
With :		
- regular liaison visits*		
- supplementary inputs* (as necessary)		
- supplementary funding ! (as necessary)		
6. 2nd major review (Leading to full technical autonomy or a return to phase 4)	2 - 3 months	15 or 20

Expatriate inputs: ** (Long-term) * (Short-term)

Funding inputs: !! (Major) ! (Supplementary)

choice would be either the Government Ministry most closely involved in and responsible for major storage developments in the country or a parastatal organisation with similar responsibilities. Our own experience, as mentioned at the outset of this paper, has often been in such connections. Figure 2 illustrates the extent and complexity of the liaison links that may be needed and indicates the probable need for a strong standing committee to facilitate and regulate this liaison. In at least two particular cases the creation of such a committee was a major "break-through" and will have remained a great asset so long as the committee has been effectively managed.

Training Needs

The most likely common need at present is for special programmes, planned and carried out locally with the collaboration of an experienced storage specialist. Such programmes should be designed to provide specific training for identified functional needs within the particular system where the trainees will subsequently operate. More broadly-based or extensive training, where appropriate, can and is being provided by various organisations including TDRI in the UK. Broad-based local or regional training programmes may also have a place wherever there are identified needs and provided such training can be effectively organised, orientated and delivered. In some regions there may be a special need for post-graduate programmes to develop research capabilities in the post-harvest field. Where there exists already a suitable institute this may be assisted in the planning and execution of such programmes by the attachment of an experienced storage scientist from an organisation such as TDRI. This has happened, for example, with "BIOTROP", the South-East Asian Centre for Tropical Biology based at Bogor in Java.

The Extension of Storage Improvements at the Farm Level

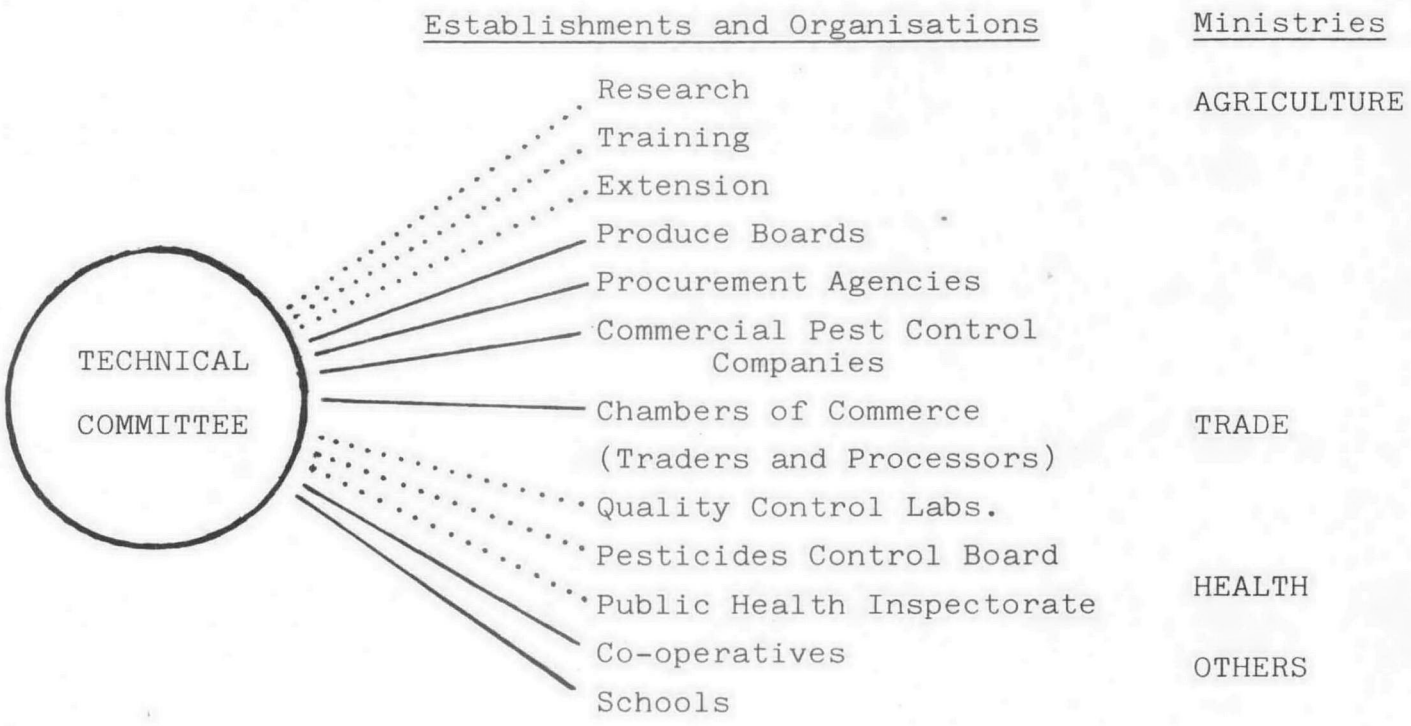
This topic has been discussed elsewhere in this paper but it may be usefully reconsidered at this point. As with all agricultural extension it may be difficult to ensure success. Progress is characteristically slow. It can usually be accelerated wherever there have been sufficient inputs by economists and sociologists to permit the correct identification of feasible objectives. There is always need to take into account all the factors that will or may affect the issue. In general, this requires the meticulous and patient application of common sense rather than a great many academic appraisals and post-mortems. The main point to reassert here is that a Stored Products Unit, required to exercise influence at the farm level, should be given sufficient capacity to participate fully and effectively in any broad-based farm-level development programmes that arise. Furthermore, even within a single country, it will need to be capable of providing a range of technical alternatives to meet various particular situations.

Conclusions

The extension of appropriate new storage technology to governmental and parastatal organisations is potentially straightforward and can be

Figure 2

LIAISON LINKS FOR A SPECIAL S.P. UNIT



Permanent (standing) representation to be determined by the local situation (with regard to Ministerial responsibilities and the Terms of Reference for the Unit)

highly effective. The key requirements are:

(i) that sufficient attention is given to the need for managerial involvement in the understanding and implementation of the proposed improvements; and

(ii) that additional technical advice is made available, when necessary, through experienced support on-the-ground.

Extension to the commercial sector is not necessarily more difficult and can be highly effective where industries have their own technical staff and public sector scientists are able to collaborate effectively with them. It is, however, extemely difficult in the commercial trading sector wherever this is not restrained by effective standards of commercial practice.

The key requirements for effective extension at the farm level are that improvements in storage technology should be closely linked to other developments in that sector and that local technologists should be able to provide a range of technical solutions to meet diverse problems in a variety of practical situations.

Training for storage scientists and technologists requires more than attendance at formal training courses, however practical these may be. It requires also the provision of exprienced on-the-ground technical support to guide developments in order to identify and attain:

(i) appropriate and effective research objectives, with more attention to fully applied adaptive research rather than to repetitive and sometimes sterile laboratory research;

(ii) appropriate and effective objectives for the special ancillary training programmes that will certainly be needed.

The essential role of a special Stored Products Unit is to provide a focal point and an experienced base for research and training. It can only do this effectively when its staff are themselves sufficiently experienced. To develop that experience there is usually a long-term need for intermittent but programmed expatriate support.

The nature and extent of the required support has been indicated in Table 3. It is clearly apparent (Table 1) that further funding is a major requirement for most if not all of the Units with which we have been concerned. However, in our view the major constraint, in most cases, is more likely to be the somewhat less obvious need for further experienced guidance in the development of appropriate research and training programmes that may, of themselves, attract more funding. This constraint could certainly be reduced, in most cases, by the provision of further expatriate inputs in an appropriate and acceptable form.

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