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PUMP SCHEME MANAGEMENT ON
THE WHITE NILE

by

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FOREWORD

This bulletin was written by Mr. J. R. Thomson, Senior Inspector of Agriculture, Dueim, as a handing over note. It has been decided to publish it as a Departmental Bulletin as it provides such an excellent and detailed description of local agricultural practice and as it is likely to be invaluable to Ministry of Agriculture officials serving on the White Nile.

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INTRODUCTION

“ Having well weighed and considered with mature Deliberation that a work of this nature cannot but be grateful to my Country, I have the more laboured to bring it to the highest pitch of improvement, supplying what has been omitted by others, who have with some diligence and industry attempted to compile a complete Body of Agriculture...well meant, because most of them had not practised what they writ, but were obliged to borrow them from others and take them on trust, and many of them from Foreign Authors, not well considering that different climates produce different effects.”

Leonard Meager (1697)

The Sudan lacks books about its agriculture and is unique enough to render books from other countries unsuitable. This became painfully evident to the small staff which opened the School of Agriculture at Shambat in 1938, and from reports, scientific journals, other people's brains and their own experience had to build up a coherent story of the science and practice of agriculture in the Sudan. Ten years later, the experience of fifty years was distilled by the Ministry of Agriculture into Agriculture in the Sudan and at last there was available a comprehensive treatise on the country's major industry. This book painted a general panorama in which detail was inevitably lacking, and the relegation of White Nile pump-schemes to a dozen pages in a long chapter mainly devoted to the Gezira Scheme was dictated by a sense of proportion. Nevertheless, the White Nile deserves more extended treatment, and this bulletin is an attempt to provide it.

The present system of management on Government Scheme is the result of over twenty years' trial and error in incorporating the fruits of research, experiments in devolution and plain common sense into pump-scheme practice. This bulletin is based on first hand experience in managing these schemes and inspecting Private Schemes. It is addressed mainly to those who are engaged in the practical job of management, but should also prove useful to teachers—for they cannot have practical experience of everything they are expected to teach—and to those outsiders who, undeterred by lack of knowledge, take an interest in pump-scheme affairs. It is no substitute for practical experience but should help the novice to avoid major blunders. Criticisms of existing practices are included on the simple principle that a fault cannot be remedied until it is pointed out.

For convenience, the schemes that are managed by the White Nile Schemes Board are referred to throughout as "Government Schemes". A system of management prefabricated in all details can not be provided for all schemes and variations in soil, climate, lay-out and type of tenant necessitate local adaptations. The bulletin is primarily concerned with schemes working with tenants on a profit-sharing basis, but much of it is also applicable to schemes worked by direct labour.

The views expressed are those of the author and not necessarily of the Ministry of Agriculture, though published under its aegis.

The subjects discussed are in a new setting, but that they are not of themselves new, is emphasised by quotations from old writers, the latest of which is dated 1726.

AVAILABILITY OF WATER

"There is one thing more which requires our Observation, and demands our study, relating to the Use of Water, Where this happens to be under Government, so as to be confined within proper Bounds, it will turn to extraordinary Advanatage to the Proprietor."

R. Bradley (1726)

The waters of the Nile flow through seven different countries : Congo, Tanganyika, Kenya, Uganda, Abyssinia, the Sudan and Egypt; but only the last two depend upon it for irrigation. From mid-July to December there is more than enough water for both these countries and the surplus flows into the Mediterranean Sea. But from January onwards, the period which includes the second half of the cotton season in the Sudan and the greater part of the cotton season in Egypt, water is so limited that not a later, the experience of fifty years was distilled by the drop is allowed to reach the sea—it all goes on to the land. The quantity available in this period has been increased by storing water in reservoirs at Sennar for the Sudan and at Jebel Aulia and Aswan for Egypt, and plans have been made for increasing it still further in the future.

The water that is actually flowing down the river during this period of scarcity has been divided between the Sudan and Egypt by agreement between the two countries. From January onwards, therefore, the water available to the

Sudan consists of the contents of the Sennar reservoir, or its equivalent, and the country's share of the natural flow. This is not sufficient to irrigate all the riverain land in the country, and it is the duty of Government to ensure that this limited quantity of water is used to the best possible advantage and that none is wasted. That in brief is the reason why everybody who wants one cannot have a pump-scheme.

As there is abundant water until December, it is important that crops should be sown as soon as possible after 15th July, so as to take as much as possible of their needs during the free period. Every watering after December means so much water less for other schemes. Cotton is usually irrigated until the end of March, but if irrigation could stop earlier, there would be a great saving of water. As a matter of fact, there is evidence that the yield of cotton is **not** seriously reduced by stopping irrigation early. In 1948 watering on parts of Hashaba and Um Gerr Schemes was stopped in mid-February and there was no loss in yield compared with the remaining areas which took water until March at Hashaba, and only five per cent loss at Um Gerr. In 1949 watering was stopped at the end of February and the loss was fourteen per cent at Hashaba and ten per cent at Um Gerr. If all schemes stopped watering at the end of February, the area of cotton could be increased by one third without using any more water, with little loss in yield per feddan and a proportionate increase in the number of schemes.

Many of the schemes can draw water only when the Jebel Aulia reservoir is full, or nearly so. If there was no reservoir there would be fewer schemes, and this applies particularly to Dueim District. Before the dam was built, dura of the "safra" variety was grown on the flood land now submerged for most of the year. Irrigated schemes produce not only a dura crop greater than the lost "safra" crop, but in addition they provide something that the flood land could never produce, a valuable cotton crop, and the White Nile is now more prosperous than ever before.

In July and August the first filling of the reservoir raises the water level to 376.5 metres above sea-level. In September the second filling raises it to 377.2 metres, and this level

is held until the end of the year at least. Emptying may begin as early as January, or as late as March or even April, the rate may be fast or slow. The actual date is not known until January, and this is one of the hazards that farmers have to face. As shown above, an early opening is unlikely to affect cotton seriously, but it might ruin the wheat crop. All pump licensees are now required to sign a declaration that they understand this and accept the risk. The date and rate of emptying are fixed each year irrespective of the needs of White Nile farmers. It is quite an impersonal matter, based on technical considerations and depending on the river for that year.

CHOOSING A SITE

“The Sixt Booke containeth a brife conference.....where in are some points necessary to be considered of such as are able and willing to Purchase Land in Fee-simple or by Lease.”

It is almost true to say that any riverside land on the White Nile can be irrigated. The first consideration in choosing a site is, therefore, the suitability of the soil.

The best soil is a heavy clay, dark in colour, and opening up wide deep cracks when dry. It is important, however, to note whether soil answering this description has many nodules and concretions on the surface. This indicates that the top soil has been removed by rain and wind, and such land has a low fertility. Land which though cracking fairly well, contains much sand, will give good crops in the first few years, but is inherently infertile and becomes exhausted. Soil which does not crack, or only slightly, is quite useless, an extreme example being “dahr” land.

The suitability of soil for irrigation, however, depends more on the salt it contains than on anything else, and this is not always obvious to the eye. Land may appear excellent, yet when irrigated the white salt comes to the surface and the crop is a poor one. That is why it is advisable to take samples of the soil and send them to the laboratories of the Research Division for analysis.

The harmful effect of salt depends partly on the quantity present and partly on the kind of salts. If there is much salt, no matter what kind of salt it is, the soil is unfit for irrigation farming. The salts of sodium are the most harmful of all. Examples of sodium salts in everyday use are common salt and bicarbonate of soda, though these particular salts may not be present in the soil in any quantity. The harmful effect of sodium depends on the kind of soil, being greater in light sandy soils than in heavy clay soils. After laboratory analysis a soil can be given a "sodium value" which indicates the ratio of sodium to clay, and the lower this value the better the soil, as far as its salt content is concerned. For example, a heavy clay soil and a light sandy soil may contain the same amount of sodium salt, but the sodium value might be as low as five for the heavy soil and as high as fifty for the light soil.

It is worth emphasising that the salt percentage and the sodium value do not by themselves provide sufficient evidence on which to judge a soil. They tell us nothing about its fertility, and this can be judged only by inspection backed by experience. "Dahr" soil may have low sodium value, but no one would dream of irrigating such land. If a soil has a high salt content or a high sodium value, it is definitely unsuitable for irrigation. If it has a low salt content and a low sodium value, it may, or may not, be worth irrigating.

There is a common belief that land which gives good crops of rain-grown dura is suitable for pump-schemes. This is by no means true. Rain crops are never heavy, frequently failing completely, and therefore, take little out of the land. Heavy irrigated crops, however, take much more out of the land and the soil may soon become exhausted. Furthermore, such soil frequently has a high salt content, and irrigation brings the salt to the surface. In areas of light rainfall a good permeable soil will not normally produce rain crops, though eminently suitable for irrigation.

On land that is not used for rain crops, vegetation is of little use in assessing its value. In general, "heglig" (*Balanites aegyptiaca*) and "talha" (*Acacia seyal*) trees give a favourable indication, "laot" bushes (*Acacia nubica*) an

unfavourable one, and tufted grasses show that the land is liable to water-logging.

At some places the reservoir floods the land on both sides of the main river channel, and when it is empty the river is far from the high-water mark on both banks. At others the reservoir floods the land on one side only, and at low level the river is close to the reservoir edge. This latter is obviously the ideal place for a pump, as water is available at all seasons, e.g. at Hashaba. Such sites are not always available, but fortunately are not essential. A pump site is good enough if it can draw water early in August. At this time the first filling of the reservoir has been completed and the pump can be sited on the point above maximum reservoir level that is nearest to the water at this time. An intake channel will be necessary, but need never be deep. Many pump-owners have not dug adequate intake channels and consequently the water does not reach their pumps until the second filling in September, which seriously delays sowing. Wad Nimr has one of the worst pump sites on the river, but has an adequate intake channel and can always start pumping early in August.

A pumping plant can irrigate a bigger area on the White Nile than in other parts of the country because of the low life, some schemes having a lift of little more than a metre at full reservoir. The area that can be watered by a pump depends, within limits, on the power of the engine that drives it, but the following is a rough guide to the areas of cotton that can be watered, with other rotational crops in proportion, by pumps of different sizes :-

<i>Diameter of suction pipe pump.</i>						<i>Area of cotton</i>
4	inches	...	...	...	...	20 - 25 feddans
5	"	...	...	...	...	30 - 40 "
6	"	...	...	...	...	50 - 70 "
8	"	...	...	...	...	120 - 150 "
10	"	...	...	...	...	200 - 250 "
12	"	...	...	...	...	300 - 500 "
14	"	...	...	...	...	400 - 500 "

A point that is usually forgotten in planning pump-schemes is the availability of sweet water from wells. Dur-

ing the summer a well enables a small garden to be kept alive, saves carrying the rest of the year provides a healthier source of domestic water than a polluted canal.

LAY OUT

As the land is flat, regular lay outs are typical of the White Nile, and the tortuous canals of the north are never seen. For the same reason, and slope of canals is very slight, frequently as little as five centimetres fall per kilometre, and on schemes with pumps of twelve inches or less, regulators are rarely necessary. Canal banks of sufficient thickness are essential to prevent excessive seepage. It is clear that the higher the water in the canal is above the level of the adjacent land, the thicker the bank must be. In practice it is found that the ratio of the height of water to the thickness of the bank should not be greater than 1 : 7 (AB : BC in Fig. 1.). This thickness will not prevent seepage in every case, especially where the soil is salty, but it is usually adequate. A common mistake is to leave insufficient space between the bank and the cultivated land, with the result that seepage makes the road impassible. The minimum distance should be six metres.

Water flows from the canal into the "abu ashrin" (field channel) through a field outlet pipe long enough to be laid under the road, and the pipe is fitted with a valve to control the flow. It is important that this valve should fit tightly when closed, as a leaking valve is a frequent cause of weed growth in "abu ashrins.". On Government Schemes these valves open in four positions, quarters-open ("one hole"), half-open ("two holes"), three quarters-open ("three holes") and fully open ("four holes"). The head of the "abu ashrin" is widened into a basin—the "dowran." If it is not made, it will be scoured out by the rush of water from the pipe, and to prevent excessive scouring its sides should be revetted with the dura straw, thorns or other material, held in position by pegs.

An "abu ashrin" is divided into sections by small earth banks. A pipe known locally as "bomba" passes through each bank, and this can be closed with a gob of mud. These earth banks serve two functions. Firstly, they act as regulators raising the level of the water sufficiently to command

the land, to be irrigated. The steeper the slope the more are required, but if an "abu ashrin" is very flat, none may be needed at all for this purpose. Secondly, they allow the lower reaches of the "abu ashrin" to dry out while the upper reaches are still watering.

An "abu ashrin" can serve up to fifteen plots or "hoshes" Plots vary from four to six feddans in area, but are usually five feddans. Along the upper boundary of a plot runs its "abu sitta" (lateral channel), which draws water from the "abu ashrin" through a pipe. The "gadwals" take off at right-angles from the "abu sitta", and there are usually two for each feddan.

"Tagnat" ridges run parallel to the "gadwals" and "rubat" ridges at right-angles. A typical plot lay out is shown in

Fig. 2.

The plot is thus divided up by the "gadwals", "tagnat" and "rubats" into "hods" (small polts) and the area of a "hod" is usually one-twentieth of a feddan. Many of the people of the White Nile do not yet understand the reason for this lay out. If the land were perfectly level, the water would spread evenly over the plot and no "hods" would be necessary. In practice, despite what was said at the beginning of the section, the land is never perfectly level, and if there were no "hods" the high places would receive insufficient water and the low places too much. By intelligent use of the "hods", the cultivator can put enough water on to the high places and prevent the low places from being overwatered. It is obvious that the more uneven the land, the smaller the "hods" should be. This point is made clear in Fig. 3. In practice, "hods" are nearly always made of a standard size irrespective of the level of the land. If more attention were given to the size and proper use of "hods", there would be less sedge.

Every plot on an "abu ashrin" should grow the same crops. This ensures that every plot takes water at the same intervals and regularly allows the "abu ashrin" a few days between waterings to dry out and thus keep sedge in check. More important still the whole number is fallow in the same year and the "abu ashrin" is dry for a whole season. It is

almost impossible to control sedge, in an "abu ashrin", that water every year.

Drains are necessary to carry off storm water, but in planning a lay out, draining is frequently forgotten. Canals should not be carried across drainage lines if it can possibly be avoided. If it is unavoidable, a siphon can be made under the canal.

WATER CONTROL

"For as the moderate overflowing of waters enricheth and fertiles the soyle, so the too much soking and long resting of the water rotteth the earth, and bringeth it to barrainnesse"

Thomas Tusser (1571)

A scheme eventually settles down to a steady watering system, but only after much trial and error in the first season or two. No scheme ever waters exactly according to the design of the irrigation engineer, and no "abu ashrin" ever draws exactly the same amount of water as any other. For a new scheme, if the output per hour of the pumping plant is known approximately a rough plan can be made on the assumption that each feddan requires four to five hundred cubic metres per watering, and a fully open "abu ashrin" can on the average water ten feddans per day. This plan can then be modified as differences between "abu ashrin" become known. The aim should be to keep the rate of flow down the canals constant during the day and from one day to the next—the system of watering by sections employed in the north is not used on the White Nile. If the land it waters is low, an "abu ashrin" will draw water faster than the average and will finish watering quickly; if the draw-off is excessive, it can always be reduced by partial closing of the pipe. If the land is high, the "abu ashrins" will draw water slowly and take a longer time to finish. To keep an even flow, therefore, the "abu ashrins" open at any one time should include an equal number of fast and slow ones, and when a pipe is closed, the one opened in its place should draw water at approximately the same rate.

It should never be forgotten that there is no storage capacity in the canals and "abu ashrins", and that the water is always moving and must go somewhere. Whenever a pipe is closed, whether it be an "abu ashrin" or an "abu sitta".

pipe, another pipe must be opened in its place. This may seem too simple and obvious to be mentioned, but the frequency of water breaks shows how often it is forgotten.

The first irrigation in July requires more water than any other. As the soil has been completely dried out and the cracks are wide open, not only does the surface soil absorb more, but the water penetrates to a greater depth. It is good practice to allow the land as much water as it can take at this stage, as the later growth of the dura crop will benefit from the deep penetration. During August and September the rain fall and humidity keep the water-demand moderate. From late September to early November the water-requirement is highest, partly because the crop area is at its maximum. Shortage is highest, partly because of the high temperatures, age of water at this time does more damage to the cotton crop than at any time, and the watering period should be twelve days. From mid-November onwards the watering period can be lengthened to fifteen or sixteen days or even longer.

On Government Schemes, the "samads" (head agricultural overseer) inform the scheme manager every Saturday how much water is required for each of their "abu ashrin" during the following week. On the basis of this information he prepares an indent showing for each day the quantity of water required for each "abu ashrin" and the total for the scheme. From this is calculated how many pumps have to work and for how long each day. The irrigation watchmen are informed which "abu ashrin" are to be opened each day and by how much. Nobody but an irrigation watchman is allowed to open or shut a pipe, and transgression of this rule is treated as a serious offence. Twenty-four hours' notice must be given of any change in the indent. If this system were applied rigidly it would soon break down, but with sufficient flexibility it works well enough. Even flexibility must have a firm basis.

As far as possible, pumping is restricted to twelve hours a day so that watering can be done in daylight. During the period of peak demand it is usually necessary to pump longer hours, but pumping longer than eighteen hours is not encouraged.

The number of "abu sitta" open at one time depends on the rate at which the "abu ashrin" draws water from the canal. The watering of a plot should be spread over two or three days, and this usually requires four pipes to be open. If it is completed in one day, as on some schemes, the water flows too fast and breaks down "gadwals", "tagnats", "rubats" and ridges. When water enters the "abu ashrin" the plots at the tail end are watered first. As each one finishes, the next one towards the canal takes over; and as each section is completed, the "bomba" is closed. In theory, there is no reason why watering should start at the tail rather than at the head, but in practice it is found to give more even watering. If watering starts at the head, by the time it reaches the tail, the cultivators at the head tend to take a second drink, and not enough water passes downstream.

The standard of watering on the White Nile is pathetic and would shock a visitor from the north. This is due to lack of a tradition of irrigated farming among the Hassaniya and their brethren, combined with innate laziness, for they are still seminomads, at heart. Lack of tradition, however, does not apply to the Gaafra. That the standard still remains so low is due partly to insufficient supervision—even the best manager cannot supervise the watering of five hundred tenants—and partly to the fact that some managers know even less about it than the tenants themselves. Bad watering-practice results in heavy sedge infestation. The tenants' idea of a remedy is to ask for a new holding, the scheme-owner's to apply for an "exchange of land".

The watering system that the tenant likes to follow is simple—open the "abu sitta", all the "gadwals" and the "hods", go home, and return next day to close the pipe and argue that the water-break was not his fault. It would be tedious to describe in detail how a plot should be watered, but here are the rules :-

1. Stay on the plot during watering.
2. Ensure that "tagnats", "rubats" and banks of "gadwals" are robust.
3. Water the high places first—this may involve opening one "gadwal" only, so as to obtain command.

4. Open enough "gadwals", usually four, to keep the water flowing not too fast and too slowly. When a "gadwal" has completed watering, close it and open another.
5. Open enough "hods" on each "gadwal" to take the water slowly. When a "hod" has finished, close it and open another one.
6. Start at the tail of each "gadwal" and work towards the "abu sitta".
7. When finished close the pipe and hand over to your neighbour, or if you are the last man on the "abu ashrin", inform the sheikh or irrigation watchman.

The mistake is sometimes made of stopping the pumps when it rains heavily. If this is done the whole scheme will dry up at the same time, and, after the pumps have started again, part of the scheme will be thirsty before the water reaches it. Unless there is an exceptionally heavy rain-storm, say fifty millimetres or more the pumps should not be stopped, and then for not more than a day. It takes a lot of rain, a hundred millimetres in fact, to equal a single watering.

6. WEEDS

"The thistle is an yll wede, and there be other wedes ... that doo moche harme."

John Fitzherbert (1523)

The most pernicious weeds are sedge and "ankoj" (*Ischaemum brachyatherum*), both perennials combining the ability to thrive in water-logged conditions and to survive drought. The eradication of these weeds is the joint responsibility of licensee and tenants, but the importance of drainage in preventing establishment cannot be too strongly stressed, and that is the responsibility of the licensee in planning his lay out. "Nagil" (*Cynodon dactylon*) is sometimes troublesome. Annual weeds present no special problems.

Sedge

A young sedge plant has a tuber at its base. From this tuber grow out rhizomes, which produce shoots above ground

and more tubers below ground. If allowed to develop, the rhizomes with their tubers spread outwards covering an increasing area, and also penetrate deeper into the soil. Eventually a matted tangle of rhizomes and tubers develops which effectively smothers the growth of any other plants. From the tubers grow out roots which penetrate to great depth. The roots keep the tubers alive during the summer, and when the surface soil is moistened again by rain or irrigation, the tubers will die in about three months in dry conditions.

On land under crop, weeding sedge with a "mangil" (native sickle), is quite useless, as fresh shoots grow up in a few days. The "milod" (hoe) is not much better. Hoeing with a "toriya" (digging hoe) cuts the roots of the shallow tubers, and if done several days before watering, the shoots will wither. Later the tuber will produce fresh roots and shoots and the hoeing has to be repeated, but it does keep the weed in check. After the crop has been well established and gives a dense cover, sedge can make little growth. The effect of cover is most strikingly seen in the lubia crop. A heavy crop completely smothers sedge temporarily but a poor thin crop encourages it and does more harm than good.

Once sedge has become established, the most effective counter-measure is ploughing—provided it is well done. It cuts the roots below the tubers, and if done at least three months before the rains, the tubers will die before the land is cropped again. Few tubers are found deeper than six inches, therefore, ploughing to a depth of six to eight inches is effective and thus can be done with a bull plough. Ploughing once in a rotation is sufficient. Land may become so heavily infested with sedge that bulls cannot trackle it, and a tractor plough may be necessary. This, however, should be exceptional; a tractor plough is expensive and its regular use is a confession of failure. Digging with a "kadanka" (heavy hoe) is sometimes practised. If well done, it is as effective as bull ploughing, but more expensive, and why should men do the work of cattle?

It should never be forgotten that prevention is cheaper than eradication. Sedge flourishes in water-logged conditions and these are provided in low-lying patches which can be eliminated by levelling. The "gassabiya" (land level-

ler) is a cheap and effective implement, and one or more, according to the size of the scheme, should be kept working every day during the dry season. In fact, in contrast to the north, one is seldom seen. High and low places may be minimised by levelling, but land can never be made perfectly flat, and, as discussed in the last section the skill of the cultivator is still necessary to ensure that the water is spread evenly over the land. Water-logged conditions, of course, are not always confined to low places and the whole plot may be water-logged by gross overwatering. Some tenants would make excellent rice-growers.

Fallow is effective in two ways. It checks the spread of the weed and gives an opportunity for eradication by thorough ploughing. Every rotation should include a fallow year.

To sum up, provided drainage is adequate, measures for the control of sedge, in their order of importance, are :-

1. Levelling.
2. Water control.
3. Ploughing.
4. Fallow.
5. Hoeing.

So far the problem of sedge on arable land has been discussed. But it is even more troublesome in "abu ashmins" and "abu sitta", where conditions are still more favourable to growth and it impedes the free flow of water and encourage mosquito-breeding.

"Abu ashmins" that water every year become excessively foul, and much less cleaning is necessary if they are periodically left to dry out completely for a year. As discussed in Section 4, this is possible only if every plot on an "abu ashmin" grows the same crops, so that the whole number is fallow in the same year.

Every "abu ashmin" and "abu sitta" should be thoroughly cleaned out every year—not once a rotation, as is com-

monly done. This is most easily and effectively done while the soil is still slightly wet. The best times are as follows:-

Cotton : April, after the last watering of the cotton crop;

Dura and Lobia : January or February, after the last lobia watering; if lobia is not grown, November, after the last dura watering;

Fallow : October, at the end of the rains. These times allow the longest possible periods for the sedge tubers to dry out before the next crop. The first step is to plough the bottom of the "abu ashrin" as deep as possible, and for this it is recommended that the plough breast be removed. In bad cases two ploughings may be necessary. Next, the sides are hoed with a "toriya". Finally, the loose soil, matted sedge, etc., is thrown on to the bank on the broadside—not the "hosh" side, as this will raise the level of the headland, so that it cannot be watered. An "abu sitta" is ploughed and the spoil shovelled on to the sides. Sedge grows most profusely in the low places where the water collects after a watering, and at the time of cleaning, these places should be filled in. The use of boning rods for detecting inequalities in slopes is easy and should be learned. During the season sedge should be kept in check by the use of the "toriya" between waterings.

"Abu ashrens" cannot be kept reasonably clean if there is water in them throughout the season. It is essential that they be given a chance to dry partially between waterings. This requires that watering should be carried out quickly, that pipe valves should not leak when closed, and that "abu ashrens" be not used as escapes for surplus water from the canal. Ideally, an "abu ashrin" should water for seven or eight days and be left to dry for a similar period before the next watering. But in practice watering in ten days, leaving five in which to dry, during most of the season, is considered satisfactory. An "abu ashrin" that never stops watering needs drastic alteration, and the advice of an irrigation engineer should be sought.

There is sedge in every scheme. Where does it come from? There is sure to be sedge growing on the land before

it is taken into the pump-scheme. Low-lying places where rain water accumulates provide suitable conditions for it, and from these it spreads when the land is irrigated. Furthermore, millions of tubers float down the river, and many of these are carried on to the scheme in the irrigation water, and some of them germinate. Little grows from seed.

“Ankoj”

“Ankoj” grows in tufts which are extremely hardy and can remain alive over the dry season. It is spread by seeds and not vegetatively like sedge. Owing to the heavier rainfall, it is more common in the southern part of the district than in the north.

Seeds may remain enclosed inside the leaf sheaths, and for this reason, after the fallow has been ploughed, the “ankoj” plants should be collected into heaps and burned. Apart from this, no abnormal operations are required to prevent “ankoj” from taking hold on a scheme; all that is required is the efficient carrying out of normal farming practice. First of all, the plants should be hoed out with a “toriya” in the growing crops—a “mangil” or “milod” is *useless—before they set seed*. This is not heavy work, and managers rightly object to financing the heavy work on fallows when it could be done much more easily in the preceding crops. Secondly, ploughing must be done well enough to cut through the roots of every tuft.

If a scheme is allowed to become badly infested, the only remedy is disc-harrowing of the fallows during the rains before the “ankoj” sets seed, accompanied by increased diligence in hoeing growing crops.

7. PLOUGHING AND RIDGING

“Plowes be of dyvers makinges. But howsoever they be made, if they be well tempored and go well, they may be the better suffered.”

John Fitzherbert (1523)

Ploughing and ridging are the responsibility of the tenant, but it is a responsibility which he has not yet shown himself capable of taking. This makes nonsense of suggestions that the sometimes made that tenants should be allowed even greater responsibilities in the running of pump-

schemes. In its own interests, and that of the tenant, this work has to be carried out by the management. On Government Schemes the actual cost of ploughing, ridging, etc., is charged to the tenants by deducting it from the price per kantar paid to them for their cotton. On Private Schemes a flat rate per feddan is charged by the management.

One pair of bulls is required for about every sixty feddans of cotton. On Government Schemes, the bulls are based on bulls yards, each yard having up to ten pairs of bulls. On the larger schemes, the yards are distributed over the schemes to reduce the distances the bull have to walk to work. At each yard there are two men responsible for the feeding and health of the animals. Each ploughman takes his pair over in the morning and returns it to the yard when work of the day is finished, and there his responsibility ends. For feeding, an equal amount of dura straw ("gassab") and if necessary dura, is collected from each tenant. Other feeding-stuffs are purchased. The men responsible for feeding are paid a monthly wage, and the ploughmen are paid at piece-work rates depending on the type of work.

Why is this organisation necessary? Why is it that a tenant never does his own ploughing even when he is offered a pair of bulls and a plough and can recover the wages that would have been paid to the ploughman? Why, although he keeps enough animals to endanger his own crops and those of his neighbours has he never a pair able to plough? It involves work, of course, but the real reason is that he has the same attitude as is found in primitive African peoples to animals, and regards them as visible signs of wealth and prestige rather than economic or utilitarian assets. He spends all his profits on buying more of them, and when in desperate need for money, will sometimes sell land rather than animals. Even if he owned a cow genetically capable of giving a high yield, he would not give it enough food to enable it to do so, and even if he did give it enough food, he would still be either too lazy or incapable of milking it out properly. The idea of using his bulls for work is entirely foreign to him, and suggestions that cows could plough are looked upon as sheerest fantasy. The ploughmen who daily break this tradition are treated with the greatest contempt—ploughing is slaves' work.

It will take a long time to break down this attitude to animals, but as settled farming comes to be accepted it will weaken. The aim should be for tenants to keep fewer animals keep them in better condition, and always have a pair fit for ploughing. If every tenant owned a ploughing team much more work could be done with animals than is done now, for example, ridging dura, interrow weeding and leveling; and it could be done at the most effective time. Even so, there would not be sufficient work on one tenancy to keep a pair of bulls busy throughout the year, but there is no reason why cows should not be used. Milk is never produced for sale, and there would not be enough to affect the domestic supply seriously. Such dual-purpose cows are common enough in the north, and are economically sound on small holdings

Ploughing

Ploughing cannot be carried out efficiently unless the reasons for it are understood. It renders the soil liable to wind erosion and should not be practised unless it is really necessary. The physical action of ploughing has little effect on the fertility of the soil. A plough can be used to prepare a tilth for crops that are not to be dibbled, but it is not the best implement for the job. In practice, the only purpose for which ploughing can be justified on the White Nile is weed control, and that means sedge and "ankoj". From Dueim southwards, the risk of infestation with sedge and "ankoj" is considerable, and all land should be ploughed at least once in every cycle of the rotation. North of Dueim the risk is less and ploughing is necessary only on areas which show the early stages of infestation.

If its purpose is borne in mind, the attributes of good ploughing are obvious—thoroughness, on islands of unploughed land being left and sufficient depth to cut below the sedge tubers. For consistently good ploughing, four things are necessary: suitable ploughs, ploughmen who know how to plough, bulls fit and well fed, and a manager who understands ploughing. The first can be obtained easily, but to judge by their rarity, not the others.

The best plough is a one-way plough of the Ransome's ET type. Ploughs that are not one-way tend to disturb the level of the land. Poles ("gassabas") and yokes ("nafs") are not supplied by the makers and have to be made locally. The pole should be straight and at least six feet long with four or five holes for the coupling, so that the point of attachment to the yoke is adjustable. The depth of ploughing depends on the length of the pole from the frame to the yoke, greater depth requiring a longer pole. The yoke should be thick enough for the comfort of the bulls and well padded where they take the strain. The width of the cut taken by the plough depends on the distance between the "asfurs". For ploughing, they should be a metre and a half apart at most.

Skilled ploughmen are extremely rare, and the work usually done is of as much use as the scratching of hens. The first thing the ploughman has to learn is how to adjust his plough. If the plough is properly adjusted, good work requires little exertion from the ploughman—for him it is almost as easy as walking. The hard work entailed in ploughing is due to bad adjustment. If the yoke is too long and one bull walks in the furrow, a strip of unploughed land will be left between this furrow and the next. If the ploughman tries to rectify this by pushing the plough sideways, he gives both himself and the bulls extra work to do and also reduces the depth of ploughing. If one of the bulls is driven out on the ploughed land to keep the furrow slice at the correct width, he is given more work to do, as he has to walk on rough ground—try it yourself! Moreover, he will not walk straight and the plough will either run out or dig in too far, despite the lunges of the ploughman to prevent it. If the yoke is of the correct length, then one bull walks in the furrow, the pole follows at right-angles to the yoke, the plough runs neither out nor in, and the ploughman has little to do but walk behind. If the first furrow is straight and one bull always walks in a furrow, all subsequent furrows will be straight. Straightness shows that no islands have been left. If the plough is a one-way one, it should be used as such i.e. when it turns at the end it should return along the furrow that has just been made. The depth should be six to eight inches, and this is easily attained if the adjustments are correct. With work of a high standard, about two-thirds of a feddan can be ploughed in a full day;

but as ploughmen seldom work a full day, about half a feddan is as much as can be expected. Ploughing is done parallel to the "abu ashrin".

Incidentally, wind-blown sand is liable to be desposited on the headland next the "abu ashrin" raising the level of the land and making it difficult to water. After ploughing, therefore, some of the loose soil should be shovelled on to "abu ashrin" bank.

If a bull is to work six days a week, he must be well fed, to give him some straw and turn him loose for part of the day to forage for himself is not enough. He requires per day about eight bundles of good "feterita" straw—not "Wad Fahl"—and eight rotls of either dura or oil cake, or a mixture of both. The straw should be fed morning, noon and evening, and the concentrates morning and evening. If dura is fed, it should be kibbled, as otherwise passes through in the dung and is wasted. A bull should be fed every day whether he is working or not, but if he is idle for more than a day or two his ration of concentrates should be reduced by half.

The most prevalent disease of bulls is liver-fluke. This disease is transmitted by snails and animals contract it by wading into the shallow water at the river's edge to graze. They may also become infected by drinking canal water or by grazing along canal banks, but the risk is much less. The disease can be cured, if it has not gone too far, by dosing with hexachlorethane, and this drug is also effective in preventing the disease if the animals are dosed twice a year. Even if this treatment is followed however, it is safest to keep the animals away from the river. It should be remembered that if a new bull is brought from the White Nile, it is almost certain to be infected, no matter how healthy it may appear. There is always a risk of rinderpest and bulls should be inoculated against it every year.

New bulls should not be worked too hard at first as their humps are soft and they require time to harden. All animals should be ringed, or at least have a rope through the nose. Castration is not usually necessary.

The main responsibility for the poor standard of ploughing lies with the scheme managers; ploughmen would not plough badly if they were not paid for it, and they are capable of learning. Many managers take no interest in the work, and their only answer to criticism is to blame the ploughmen. This attitude puts schemes which insist on a high standard at a disadvantage, for a ploughman will not remain on such a scheme when he earns as much for bad work elsewhere. This manager should watch the ploughs at work as often as possible, point out faults, show the ploughmen how to rectify them, and refuse to pay for bad work. This, of course, requires that the manager himself understand ploughing, and how many do? Furthermore, he should frequently inspect the bull yards and see that none of animals are ailing and that they are being properly fed. It is not enough to give an order that they should receive so much food per day, he must go and see that they get it.

Ridging

A plough of the Ransome's ET type is usually employed for ridging. The ploughing breast and share are removed and replaced by ridging breasts and share. The pole requires to be shortened for shallower work and the yoke lengthened to give a distance of about eighty centimetres between ridges. If the land has not been ploughed previously, ridging is sometimes done twice for cotton, the plough being set deeper for the second ridging. This is not absolutely necessary, but it gives a better ridge. Ridging-shares are made of softer metal than ploughing-shares and soon wear out when used for ridging unploughed land. They were never intended for such work and have to be renewed about every five feddans. The ridges run at right angles to the "abu ashrin"; the "abu ashrin" gives a straight line on which to start each plot, and after that everything is easy.

It is worth considering whether bulls could be replaced by tractors with advantage. From the point of view of the manager, tractors might be less troublesome, but the manager who neglects to supervise his bull ploughing is just as likely to neglect to check the oil in the tractor sump, and with expensive consequences. Furthermore, unless adequate

arrangements are made for maintenance and the supply of spares, the break down of a tractor causes much more delay than the death of a bull. The decisive point, however, is that bulls can do the work adequately and more cheaply especially such work as "taqtiya" (preparatory work done prior to watering). A probable future development is the reduction of the manual labour required in weeding, and this work requires a large area to be done in a very short time. It would be quite uneconomic to keep enough tractors to do it in time, but it could be done if every tenant had a ploughing team. It should never be forgotten that the work of bulls is paid for by the tenants. If he were to keep his own animals and do his own work, his cash debits would be negligible. Under the present system, most of the money he pays remains within the district. If the work were done by tractors, most of the money would not only leave the district, but leave the country. The Sudan of today cannot live without imports, and these can be obtained only in the exchange for exports. The country is exporting less than it did before the war, and imports can be justified only by necessity: The test is whether routine tractor-ploughing is necessary for the maintenance or improvement of cotton yields, and the answer is "No". The use of tractors should be restricted to the odd pieces of land which, despite good management, inevitably become infested with sedge.

This raises the general question of mechanisation on pump-schemes. If it is started, where is the process to stop? The logical outcome would be for all the work to be done by the management, with mechanised means, on behalf of and paid for by the tenant. All that would be left for the tenant to do would be to report to the office and collect the balance of money due to him, and inevitably he would complain that it was not enough to live on. The money he receives at present represents in part a wage for his work and in part the profit on the sale of his cotton, and the former would go elsewhere. He cannot have both his wage and his leisure.

8. ROTATIONS

*"I have knowne arable land borne good corne time out of minde,
with every third years rest and fallowing."*

Gabriel Plattes (1693)

The main crops on White Nile pump schemes are cotton, dura and lubia (*Dolichos lablba*). Dura is an exhaustive crop, lubia takes nothing out of the land and may even contribute something, and cotton is intermediate in this respect. An area of dura equal to at least half the cotton area is obligatory under the Nile Pumps Control (Blue Nile Tenancies) Regulations.

Fallows take an important place in all rotations practised. A fallow performs two main functions. First of all, nitrogen-fixation is always going on in the soil, and if the land is left uncropped for a year, this nitrogen accumulates and is available for the next crop, giving an increased yield. Secondly, it checks sedge infestation and provides an opportunity for cleaning land and "abu ashrin". It is doubtful if it has any deterrent effect on "ankoj"; in fact an uncleaned fallow may allow this weed to establish itself more firmly. There is evidence that the yield of the following crop is still further increased if the annual weeds on the fallow are hished, but there is an element of doubt about it, and the practice cannot yet be recommended with confidence.

Can the practice of leaving a third or more of the land uncropped every year be justified? A fallow is equivalent to the application of fertiliser, and if purchased, this would cost much more than the ten piastres per feddan that is paid in rent. As long as there is not enough water to irrigate all the irrigable land, the aim must be to obtain the maximum yield per cubic metre of water rather than per feddan. This is achieved by the following, which decreases the yield per feddan or gross area, but increases the yield actual feddan of crop. If in the future, abundant water becomes available, fallowing may then be dropped, but that will require a higher standard of farming.

A scheme usually gives high yields in its first years, but this is not maintained, and the scheme later settles down at

a lower level of fertility. The rotation practised is sometimes blamed for this falling off, but it is only to be expected and cannot be prevented by any rotation. It could, of course, be avoided by shifting cultivation, but this wasteful practice is a relic of barbarism.

The rotation practised on all Government Scheme, except part of Fatisa, and on most Private Schemes, is a three-course one of cotton-dura and lubia-fallow. The dura and lubia should alternate between the halves of each plot, making in fact a six-course rotation of cotton-dura-fallow-cotton-lubia-fallow. This rotation has proved satisfactory under good management, but on the poorer soils fertiliser is necessary to maintain the yield of dura.

A modification on Government Schemes is to allow each tenant to sow a crop of his own choice on one feddan of the cotton area, the only restriction being that it must take water during the cotton-watering season and at the same intervals as cotton. This is known as the "free feddan", free in the sense of freedom of choice, but not necessarily freedom from charge. The crops usually grown are wheat and dura, and in fact they are free from charge. The free feddan is always followed by lubia in the next season.

On many Private Schemes there is a modification by default, for lubia is not grown. The cotton is followed by half dura and half fallow, but the dura is grown on any part of the plot and no attempt is made to alternate it between the two halves. However, if lubia were included on these schemes it would be badly grown, so its omission is beneficial.

On part of Fatisa Scheme there is a four-course rotation of cotton-lubia-dura-fallow. As only a quarter of the land is fallow, this rotation is economical in canalisation. There is no evidence of difference in cotton yield between this and the three-course rotation, but the dura yield is perhaps better on the four-course. Striga infestation is less on the four-course rotation, as some of it is destroyed by the preceding lubia crop. Three years' successive cropping is liable to encourage sedge, therefore this rotation requires a high standard of water control.

Another four-course rotation has been introduced on some Private Schemes, but it is too early yet to judge of its success. It recognises the inability of the people of the White Nile to grow good crops of lobia, and the sequence is cotton-fallow-dura-fallow. Compared with the three-course rotation, it should give better crops of dura on the proper soils, as it follows a fallow, and fallows in alternate years should check sedge infestation; but it has its disadvantages. As the half land is fallow, canalisation costs are high. Seeds which fall from the cotton crop germinate during the following rains. If cotton is followed by another crop the seedlings are hoed, but if followed by a fallow they may not be hoed, and there is, therefore, a great risk of blackarm and leaf-curl diseases. It is very doubtful if this rotation will check "ankoj"; in fact the extra fallow is liable to encourage it. It is, therefore, not recommended where "ankoj" is a menace.

Finality has not yet been reached as to the best rotation for White Nile conditions, but it is unlikely that one rotation will be found suitable for all schemes. It is clear that the following factors have to be taken into consideration: needs of the tenants, fertility of the soil, proneness to sedge and "ankoj" infestation, disease, capital costs, profitability, availability of water, standard of water control and of management.

The cotton crop is shared between management and tenants, and other crops in the rotation are entirely the property of the tenants. The minimum ratio of tenant's crop to shared-crop area laid down by law is a half, but the variations between the different schemes are interesting:-

Scheme	Area of cotton plot	Ratio, tenant's crop : shared
Fatisa (four-course)	4 feddans	2.0
Hashaba, Dueim,		
Fatisa (three-course)	5 „	1.5
Um Gerr, Wad Nimr	6 „	1.4
Private Schemes	...4 or 5 „	1.0 or 0.5

9. COTTON

Gabriel Plates (1693)

"There is a knight now living in London that got a thousand pounds per annum by planting carrets."

Adam Speed (1659)

Cotton is the keystone of the White Nile farming system. It is the cash crop that pays for the pumps, brings in Government revenue, and provides the purchasing power of the inhabitants for anything from coffee-cups to saloon cars.

On Private Schemes the variety always grown now is X1730, which is a derivative of Sakel, but on Government Schemes it may be either Sakel or X1730. Compared with Sakel, X1730 is resistant to leaf-curl disease, suffers less from an attack of blackarm, gives a higher yield and is easier to pick, but its quality is poorer. There are two factors in its higher yield, more kantars of seed cotton per feddan on picking, and more rotls of lint from each kantar when ginned. It fetches a lower price, but this is compensated for by the higher yield.

The question of sowing-date is a vexed one. The one thing that is certain is that sowing cannot start before 15th July. Considerations involving availability of water have been discussed in Section 2, and there can be no sympathy for anyone who sows so late as to require water in April. If there were no risk of pests and diseases, the earlier the sowing the better, as late sown crops give lower yields and poorer grades. Unfortunately, the risk of pests and diseases is ever present, and early-sown crops are more liable to attack by the worst of them. The problem, therefore is to find the earliest date at which the crop can be sown with a reasonable chance of escaping the plagues. To escape blackarm, research has shown that the average date of sowing should not be earlier than 15th August, and starting dates varying from 5th August in the north of the district, to 25th August in the south, can be recommended. Avoidance of jassids, which may cause serious damage north of Dueim, requires a later sowing-date, and some schemes do not sow until September, but now that spraying against this pest is available to all, this is no longer a valid excuse. Pink bollworm and leaf-curl attack the crop later and increase throughout the picking season, and if the crop is

sown early, the bulk of the cotton is picked before they become serious. On balance, the advantage is with August sowing, but the extent of the advantage to the individual depends on difference in price between the top and bottom grades.

Avoidance of pests and diseases is usually given as the excuse for late-sowing, but in truth it is due to sheer dilatoriness; the pumps are not ready, ridging has not been finished, the tenants have not returned from the "qozes", and even the water may be late because an intake channel has not been dug.

Whatever the sowing-date, preparatory work must start a long time ahead. Ploughing should start as soon as green ridging of the previous crop has been done, and should finish not later than March, so as to allow enough time for the sedge tubers to die off. Ridging follows and is completed by June, to be followed by "taqtiya" of both cotton and dura. The rains of late July and early August produce a heavy growth of weeds and necessitate weeding before sowing. It would be better to postpone ridging till after this weeding in order to avoid breaking down the ridges, but time is short between weeding and sowing, and the work so liable to interruption by rain, that under the present system of ploughing it would never be done in time.

Seed is supplied by the Ministry of Agriculture, and it is illegal to sow seed from any other source. All seed is treated against blackarm and pink bollworm before it is issued. One "keila" (22 rotls) per feddan is sufficient. The seed is sown on the ridges at about six seeds per hole. Ideally, the spacing should vary with the season, closer in a poor growing-year and wider in a good one, but research has shown that for an average season thirty centimetres is best, and this distance should be adhered to. The seed can be dibbled in on dry land, but to get the crop away to a good start it is better to irrigate before sowing, unless there has been enough rain, and sow with a "seluka" (sowing stick).

Good germination can be depended on, but some re-sowing may become necessary for a variety of reasons, such as flea-beetles, thrips, termites, crickets, flooding, or failure

to hoe in time. Resown patches never do as well as the surrounding cotton, and to give them as good a chance as possible, the resowing should be done immediately the need for it is noticed. Some experienced cotton-growers recommend that if much re-sowing is necessary, the whole crop should be wiped out and a fresh start made. The insect pests can be controlled by dusting with an insecticide such as gammexane. If thrips are severe, more frequent waterings should be given.

Soon after sowing, weeding is required again, and this should be continued until the crop is well established in late September or early October. There is nothing more harmful to the crop than to allow weeds to grow until the cotton becomes drawn up and loses colour. After the crop is established the only cleaning required is to pull out "ankoj" plants. The seedlings should be thinned to three or four per hole about three weeks after sowing; this operation is frequently either neglected or left too late. After the last hoeing the drills are given a final ridging-up. Repair of ridges and water-channels after re-ridging is sometimes neglected.

If the crop is to be sprayed against jassids, October is the best time to do it. Spraying may require some manipulation of the watering programme to ensure that there is a large enough area of dry land available every day to keep the spraying-machine busy. Ridges and water-channels have to be broken down at the correct intervals for the tractor wheels, and their subsequent repair must not be forgotten, whether visible from the road or not. All this is unnecessary of course if the spraying is done from the air.

Cotton comes into flower in October, opens its first bolls December, and is ready for picking in January. The bolls open in a series of flushes, four or five in a season. The first flush gives the finest grade, and as the season progresses the grade deteriorates. When a flush is ready, it should be picked quickly and completely, and immediately packed for dispatch. Cotton from one flush should not be mixed in the same pack with cotton from an earlier or later flush, as this gives a mixture of grades, and the whole pack will be given the grade of the poorest cotton it contains. Some mixing is unavoidable in practice, but it should be reduced to a

minimum. A flush must be picked clear before the next watering, otherwise the cotton will be shed before the ground is dry enough for picking again. On pump-schemes it is possible to advance or retard a watering to ensure that the land is dry at the right time, but with good tenants this is not often necessary. Strong wind is frequently given as an excuse for shedding, but the answer is that it should be picked before it becomes so easy to dislodge. For efficient picking, the pickers must work systematically and not roam about, picking where the cotton is thickest and neglecting where it is thinnest. Each picker should take two ridges and they should walk across the plot in line from one side to the other. Good picking requires the constant attendance and vigilance of the tenant. Arguments about payments to picker can be avoided if each tenant has a spring balance.

On Government Schemes each tenant is responsible for picking his cotton tightly into packs. This is most easily done with a "gallows". The packs are supplied by the management, and each holds about 1.2 kantars. Each sheikhship is allotted one day per week on which its cotton is taken over, and on the appointed day the tenant takes his packs to the collecting centre. There they are inspected and, if the contents are clean, accepted. If the cotton is dirty, the tenant has to unpack it, clean it and pack it again. Each pack is numbered and weighed, the number weight and name of the tenant being recorded. The tenant receives a slip showing the weight and the payment to which he is entitled, and on presenting it at the office, receives his money. The packs are dispatched to the ginnery as expeditiously as possible, as delay is liable to cause loss of grade. Each consignment is accompanied by a consignment-note in duplicate giving the number and weight of each pack and the tenancy from which it came. At the ginnery each pack is weighed again and graded, weight and grade recorded on the consignment-note, and one copy returned to the scheme manager. Waybills or policies are also required according to the method of transport.

The ginnery may have to deal with half a million bales in a season, and the chaos that would result from inefficient organisation can be imagined. But even the most efficient organisation at the ginnery requires the co-operation of the schemes from which the cotton comes. This should be borne

in mind by the scheme manager, and he will earn the gratitude of the ginnery staff if he attends to the following matters:

- (a) Arrange for a representative to be present at the ginnery to hand over the cotton and repair torn packs;
- (b) Keep the cotton flowing in small consignments rather than send it in large consignments at long intervals;
- (c) Ensure that the packs are strong enough to arrive at the ginnery intact and survive handling there;
- (d) Ensure that a consignment-note accompanies each consignment and that it is accurate;
- (e) Make arrangements for the return of empty packs.

On Private Schemes the cotton is not packed on the tenancy. The tenant takes it to the collecting-centre, and it is packed there. An advantage of this system is that, provided it is brought in promptly, there is less chance to cotton from two flushes being mixed in one pack.

To avoid misunderstanding, it should be noted that the grading systems for Government and Private Schemes are not the same, and therefore, comparisons cannot be made on this basis.

Tenants are forbidden to take cotton to their homes or to dispose of it in any way except through the management, which is responsible for sending it to a licensed ginning factory. Apart from the effect of this practice on the management's share of the cotton profits, the reason for this is that the seeds may contain the resting stage of the pink bollworm, and if they are kept until the following year, the bollworm will emerge and attack the next crop. From the ginnery the seed comes under the control of the Ministry of Agriculture, which takes steps to destroy the bollworm if it is to be issued again for sowing.

After the picking has finished, animals are allowed into the cotton to graze; then comes one of the most important and unpopular operations of the year, root-pulling and cleaning up. Every plant has to be pulled out by the roots

with a special gadget, to prevent the development of leaf-curl disease in the following season. If the plants were left, some of them would survive and develop fresh growth in the rains. A plant may have only a very mild attack of the disease at the end of the season, but if it is left and survives, the fresh growth will show severe symptoms of the disease, and from such plants the whole of the next crop may become infected. Cutting out the plants with a hoe is not enough and must always be guarded against, as fresh shoots may grow from the roots that are left in the ground. Incidentally, this disease is transmitted by white-flies and they can transfer it from "bamia" (*Hibiscus esculentus*) to cotton.

The stalks are gathered into heaps. Then all the plant debris is swept up and thrown on to the heaps, which are then burned. All parts of the plant are liable to be infected with blackarm, and the seeds and bolls with the bollworms; and burning them prevents any carry-over of these plagues to the following season's crop. Tenants are not allowed to carry the stalks away to their houses, much as they would like to, and everything must be burned on the tenancy. If they were to use every bit of stalk and debris as fuel no harm would be done, but they are liable to use the stalks for zaribas and other purposes and thus leave a source of infection for the next crop.

The date by which the destruction of plants and debris must be completed is announced by the Governor each year, but it is usually 31st May. It is in the interests of all that it should be done punctually and effectively. Failure to do so is as much a crime as arson. It is hard and unpleasant work with no immediate incentive, though early pulling improves the following dura crop, and on Government Schemes part of the cost is paid by the management, but it would be done much more willingly if everybody concerned understood the reasons for it. The ignorance of such matters among owners, managers and tenants is appalling. Only on the older schemes have the people of the White Nile actually experienced a severe outbreak of blackarm or leaf-curl, and it is to be hoped that such a grim lesson will never be necessary. Pink bollworm is bad enough already.

The yield of cotton on individual tenancies ranges from one to eleven kantars per feddan, but the average over all schemes is between two and a half and three kantars.

In recent years fertiliser has been applied to cotton Government Schemes, but it is not yet a general practice. There is no doubt that the crop responds well to nitrogen, and an application of sixty kilograms of ammonium nitrate per feddan, or its equivalent can be depended on to increase the yield by at least half a kantar per feddan. Its profitability depends, of course, on the relative prices of fertiliser and cotton. There are various kinds of fertilisers providing nitrogen, and some of them are unsuitable for White Nile soils; for example, sodium nitrate. It is as well, therefore, to consult the Inspector of Agriculture before buying any. Nitrogenous fertilisers should be spread on the ground before ridging, and there is no harm in doing it before ploughing. Burying is important in the case of fertilisers containing ammonia, as if this is not done much of the value is dissipated into the air. It is worth noting that the following crops receive some benefit from nitrogen applied to cotton. Little is known about the need for other fertilisers such as phosphates and potash. They are unlikely to increase yields on the heaviest land, but they are worth a trial on lighter soils.

10. DURA

“Make sure of bread-corn.”

Thomas Tusser (1571)

Dura is the staple food of the people of the White Nile, and shows no sign of abandoning its cultivation in favour of cash crops. The rain crop can never be depended on, and the river has always provided an insurance crop to be eaten in years of drought and sold in years of heavy rainfall. It is an essential crop, and has the advantage of being irrigated during the period of abundant water. It is to be hoped that the inhabitant of the White Nile never changes the basis of his diet. The most likely alternative is wheat, and that would compete with cotton for the limited water available from January onwards.

The favourite variety on pump-schemes is “feterita” of the same strain as is grown on the rainlands. It gives a

good yield of fair quality grain, straw of high feeding value, and some stubble grazing. A further attraction to the tenant is that after cutting it tillers well on stolen water. "Wad Fahl" is popular on the poorer soils where it produces an excellent yield of high quality grain, but its straw is long and coarse and unsuitable for stock feeding, and it is less drought-resistant than "feterita" and requires at least one more watering. Because of its faults it is advisable to limit the area of this variety to half the total dura area. "Dwarf white milo" has the disadvantages of poor quality grain for brewing, difficult threshing, coarse straw and liability to cross pollination, but it yields well and many tenants who have been induced to try it have continued to grow it. Other varieties grown in small amounts are "gas-sabi", "wad akr", "fiki mustafa", and "safra", this last being very suitable for late sowing. It is remarkable, however, how the popularity of all but the favoured "feterita" varies from year to year.

Two considerations are involved in determining the sowing-date. Firstly, early-sown crops are superior to late-sown ones, and, therefore, sowing should be as soon as possible after 15th July. Secondly, neither the sowing nor the weeding should clash with the peak demands for labour on the cotton crop. On Government Schemes, other than Wad Nimr, sowing starts on 16th July, and sowing and first weeding are finished before the cotton is sown. At Wad Nimr the water does not arrive until the first week of August, and the dura cannot be sown until the second half of the month, after cotton-sowing. If the dura is sown about ten days after the cotton, a clash between the first weeding of the two crops can be avoided.

Dura follows cotton in the rotation, and after the cotton plants have been pulled out, all that is usually done is to dig out the "ankoj" with a hoe and make up the watering ridges and channels. The crop would benefit, however, from making up the ridges again. Fertiliser is rarely applied.

The seed should be taken from selected heads from the previous harvest. Dusting the seed with either copper carbonate or sulphur is advisable to prevent smut. Copper carbonate is the more effective, and only one "waqia" per "keila" of seed is required. The cost is infinitesimal, but

it is seldom practised outside Government Schemes. Ten to twelve roths of seed per feddan is sufficient, and it is sown on the old cotton ridges. Like cotton, dura can be sown dry, but it is better sown with a sowing stick after rain or irrigation.

Two or three hoeings are required, and for "feterita" usually about four waterings, depending on the rainfall. "Feterita" produces its first heads about six weeks after sowing and is ready for harvesting after another six weeks.

Harvesting is done by cutting each head off separately with a knife and throwing the heads in a heap on a mud plastered threshing floor. Later, the heads are threshed with fails. After threshing, the threshing floor should be broken up, as if left it may form a hard impermeable patch liable to affect succeeding crops. The straw should be cut as soon as possible to prevent its drying out completely and losing its feeding value, and then stacked. The stacks should be protected by thorns and kept as long as possible. Tenants tend to feed straw to their animals immediately after harvest, with the result that by April there is not a bit of forage left between Kosti and Jebel Aulia.

Yields vary from twenty to a hundred "keilas" per feddan, but usually average round about fifty. On a normal holding, this gives enough to feed an average family, but in years of scarcity it is not enough for the rainland-relatives as well.

11. LUBIA

"It doth so frame the land that being ploughed it will yield three or four years together a crop of wheat, and after that a crop of oats..."
Andrew Yarranton (1663)

It is desirable to include in a rotation a crop which is restorative and provides forage for animals. Naturally the choice fell on a leguminous crop because of its ability to absorb nitrogen from the air, and the most suitable one for White Nile conditions appeared to be lubia, which had been introduced into the Sudan from India. We now know that in fact it may not add much nitrogen to the soil, but at least it takes none out of it. Unfortunately, though no

more difficult to grow than leguminous crops, it still requires more care than most schemes are prepared to give it, and more care is required in the southern part of the district than in the northern. Where it is well grown, it has turned out to be much more than a forage crop. The pods are eagerly picked and sold before grazing, and it is now a valuable cash crop.

The best date for sowing depends on two factors. Like cotton, early-sown crops make the best growth, but are liable to disease. The growth of lubia is much influenced by light, not the amount or intensity of light, but the number of hours of daylight per day. If a plant is kept in conditions where the day is long and the night short, it will grow vigorously, producing abundant branches and leaves, but will never produce flowers. If this plant is then changed to conditions in which the days are short and the nights long, it will soon produce flowers. In other words, long days encourage vegetative growth, and short days encourage flowering. If lubia is sown in the long days of summer it will make vigorous vegetative growth until the shorter days of winter come, and then it will flower. If, however, it is sown in the short days of winter it will make little growth, and will soon flower. The sparse growth of late-sown lubia, besides yielding little forage or seed, encourages weed-growth, and therefore, sowing should be as early as possible; but if too early, there is the risk of a disease very similar to blackarm of cotton. The time recommended is the second half of September, which allows the crop time to form a dense cover before flowering starts towards the end of November and involves little risk of disease. Crops sown in October may do well enough, but sowing later than this is a waste of time. This date fits in fairly well with other work, as the dura is established by this time, though there is still work to be done on the cotton.

It cannot be too strongly emphasised that unless lubia is grown well enough to produce a dense cover, it is better not to grow it at all. A poor thin crop encourages sedge and does more harm than good.

Lubia is very sensitive to water-logging, and the first essential for a good crop is ridging. The old cotton ridges are not high enough and have to be ridged up again. As

sowing is relatively late, there is a heavy growth of weeds to be hoed off beforehand. If the ridges were made up early, they would be badly broken down by this hoeing, and it is better to leave it until August or September. This means getting every plough out on every day dry enough for work, but as the area is not great the work can be completed in time.

“Taqtiya” and sowing follow immediately. Seeds are sown with a sowing stick on the ridges, three or four to a hole, at about thirty centimetres’ spacing, about a “kejla” (281/2 rotls) being sufficient for a feddan. Two or three hishings are necessary, but should be continued until growth is dense enough to prevent further weed-growth. As lubia is so sensitive to water-logging, over-watering must be avoided. Many feddans are killed by flooding every year.

Unless special permission is obtained, lubia may not be irrigated after December. The usual practice is to pick the pods in January and then graze the crop off. If water is available, it should be kept going as long as possible before grazing is allowed. In March there is great pressure to turn the animals in to the cotton, but if the lubia grazing can be preserved until then, the cotton is spared. If the growth is good and water is available after December, there is a much better way of utilising the crop. A cut should be taken just before the crop flowers in November and made into hay, and the pods picked from the second growth, which is then grazed off. By this means not only is the yield of forage increased, but some of it is preserved for feeding later, when no grazing is available. This practice is followed by only one tenant on the whole of the White Nile. He is so satisfied that he does it every year, everybody has seen it and agrees that it is a good thing, but nobody follows his example.

There is no reason why other leguminous crops should not be grown instead of lubia, but if they do not give a good cover it is important that they be kept clean. Some tenants do in fact grow other crops on part of their lubia area, the favourites being lubia “helu” and lubia “tayyeb”. The soil is not ideal for ful Sudani, but some tenants have obtained fair yields from it. If it is to be grown adjacent to the dura and sown and watered at the same time. A variety of gram has done very well at Abdel Magid and might be introduced.

12. OTHER CROPS

*“Walk on a little farther and behold
A pleasant Garden,.....
Full fraught with necessary Flowers and Fruits,
And Nature’s choicest sorts of Plant and Roots.
..... Near unto those Fields
Stands a large Wood, Mast, Fuel, Timber yields.
..... Then do the fields appear
Cloathed with Corn and Grail for th’ensuing Year.”*
John Worlidge (1681)

Wheat

Wheat is popular as a cash crop on Government Schemes where it is permitted on the free feddan. Except on small four-inch pumps, it is not grown on Private Schemes. The usual variety is “Ba’al’i”. But “Hindi” has been tried at Wadi Nimr with good results.

As wheat requires cold weather during its growing period, it is grown as a winter crop, but there is no need to wait until the cold weather sets in before sowing, let alone doing all the preliminary work. There is nothing to be gained by postponing sowing after the first week in November, and there is definitely a risk of being caught out later by the falling reservoir.

If the land is infested with sedge or “ankoj”, it should be ploughed not later than the previous March, otherwise early ploughing is not necessary. It is important that the land for wheat be clean, and it is hoed at the same time as the cotton land.

Wheat is usually sown on the flat. The seed bed can be prepared by shallow ploughing and a native plough is good enough for the job, but the best implement is a plough of the Ransome’s ET type with a hoeing attachment. This work should be done in the second half of October, and “taqtiya” follows immediately. Water-control on wheat is no laxer than on other crops, but because of the absence of ridges the effects are worse. It is essential that the water retaining banks be strong enough to hold water, those that, like Euclid’s line, have length but no thickness, are too common. The seed is broadcast at the rate of four or five “keilas” per feddan and covered with a dutch hoe or by dragging thorns.

Another method of sowing, sometimes practised, is to ridge, broadcast on top of the ridges, and then re-ridge. An even better method is to broadcast on the flat and then ridge.

Wheat requires about eight waterings. The first immediately after sowing, should be a light one so as not to drown the crop, and the second a heavy one. From then until shooting, light waterings, only are required. The mistake is commonly made of giving heavy waterings at this time, but it should be remembered that at this stage of growth it is almost impossible to kill wheat by drought. After shooting, when the grain is filling, is the stage when wheat needs most water, and at this time waterings should be correspondingly heavy. If the crop has been sown at the correct time, watering should be finished by the end of February.

Wheat sown at the proper time starts shooting at the end of January and is ready for harvesting six or seven weeks later. It is not harvested until it is dead ripe. It is cut with a sickle near ground level, tied into large sheaves and the sheaves placed in large stooks. Threshing is done by animals of any species available, with or without a "nureg" of some description, and winnowing is by wind. Little use is made of the straw.

Vegetables

Practically every scheme includes an area for winter vegetables. The land is cultivated and fallowed in alternate years. It is usually divided into half feddan plots and allotted to local people who do not have normal tenancies. Water-rates are charged and they are fixed by the White Nile Schemes Board for Government Schemes and by the joint boards for the Private Schemes. The most popular crop is onions, but tomatoes, bamia, kusbara (*Coriandrum sativum*) and other vegetables are also grown. The original idea was that the vegetables would be consumed locally and contribute to an improved diet, but in fact most of the produce is sold for dispatch to other parts of the country and form another cash crop.

Onions should be sown in August and transplanted early in November. If this is done, they can reach maturity without taking water after March. Fertiliser for applica-

tion after transplanting is highly valued by the growers. Dung, and the soil from abandoned villages, are commonly used, which is perhaps a fair comment on sanitary conditions in the villages. In recent years small quantities of ammonium nitrate sold by the White Nile Schemes Board have been eagerly taken up, despite the high price.

Forests

Forests have been established on some Government Schemes to provide fuel and building timber for sale to tenants. It is not a project to be entered on lightly, as it involves a constant fight against the depredations of the tenants and their animals. A forest such as that at Fatisa is indeed an achievement.

Sunt (*Acacia arabica*), Nim (*Azadirachta* spp) and Baan (*Eucalyptus*) have done well. Planting is done on ridges three and a half metres wide, made by ploughing in the furrows and throwing the loose soil on to the top of the ridges. The trees can be thinned out after five years, and are ready for felling in eight to ten years. For a continuous supply of wood a small area should be planted each year.

Fruit

White Nile soil is on the whole quite unsuitable for fruit, and apart from Abba Island, there is not a single good fruit garden on the whole river. There are, however, small areas of permeable mixed soil, and when found, they should be utilised. A small garden can be kept going in the summer with water from a well. The fruit most likely to do well is guava, followed by lime, orange and grapefruit. Mangoes are problematical, but they grow well at Abba.

The most common fault in fruit-growing is to make the irrigated area round the tree too small. For a young plant this should be about two metres in diameter, and as the tree grows, should never be less than the shadow thrown by the tree at mid-day. Citrus trees require fertilisers such as ammonium sulphate or ammonium nitrate, about half a pound of the former every three months being sufficient. Applying the fertiliser to the surface, however, is not effective. About four two-foot holes have to be bored around the tree, but not too near it, and the fertiliser placed in

them. Orange, grapefruit and mango are grafted on to root-stocks of other varieties, and unless the shoots that grow out from the root-stock are pruned, they will smother the scion. Most of the inedible fruit trees in the country are due to neglect of this precaution.

13. PUMPS

*"In yonder vale, hard by the River, stands
A Water-Engine which the Wind commands
To fertilize the Meads."*

The best management in the world can produce nothing if the pumps break down. Maintenance of pumping plant requires constant care and forethought.

Questions of maintenance and efficient running arise right at the beginning when the plant is being ordered. The size of the pump should be as defined in the pumping licence, but on this point there is frequent misunderstanding. The size of a centrifugal pump is described by engineers in terms of the diameter in inches of the suction and discharge ports, and the former is usually greater than the latter, e.g. a twelve-ten pipe means a pump with a twelve inch suction and a ten-nine discharge. In the Nile Pumps Control Regulations, however, the size of a pump is defined as the average internal diameter in inches of the intake pipe for a length of three metres below the pump, and no reference is made to the discharge side. A pump with a suction port of the size indicated in the licence should, therefore, be obtained and fitted with an intake pipe of the same diameter, e.g. for a ten-inch licence buy a ten-eight pump and fit a ten-inch intake pipe to it. Frequently the pump that is bought is too big and has to be fitted with a smaller intake pipe to conform with regulations, e.g. for a ten-inch licence a twelve-ten pump is bought and has to be fitted with a ten-inch intake pipe. Not only does this raise the initial cost, but the pump cannot be expected to work efficiently under such conditions.

The power of the engine will depend on the size of the pump and on the lift, and on this point an engineer should be consulted. The simple-minded White Nile tenant tends to buy an engine that is unnecessarily powerful, like buying

a diesel truck to take a "keila" of dura to the suq. This involve unnecessary expense and inefficient running. Second-hand engines are seldom worth buying.

Having spent money on buying a pumping-plant, it is poor economy to get it installed on the cheap. Installation is a job for a skilled engineer, but it is not unknown for a pump to be put in the wrong way round. Bad installation, at the best, results in inefficient running, at the worst, in the top blowing off the engine. The best method is to get the agent to do the installation and give a guarantee for one year, some reputable agents are prepared to do this. Spares should also be obtained and the agent can advise on what is most likely to be required.

It is advisable to have a stand-by unit, not only for emergencies, but to allow maintenance work to be done without stopping pumping. A stand-by pump is often insisted on, but it must not be bigger than the main pump. Until the end of December the main and stand-by units may, with permission work together, and this is a valuable concession in October, but it is strictly forbidden from January onwards.

The pumping plant needs a thorough overhaul every year if a break down at a critical period is to be avoided. The best time to do it is between April and June, and an experienced engineer should be called in to advise, at least, on what is required.

The best insurance against break down is to employ a good experienced mechanic. He is in charge of plant that is expensive to buy and maintain, and on his work depends the profits from a valuable crop. He is, therefore, entitled to a good wage, and to save on this item is false economy. If a clerk makes a mistake it costs little or nothing, but if a mechanic make a mistake he may do hundreds, or even thousands, of pounds' worth of damage. Yet how do their wages compare ?

14. THE LICENSEE

*"The master's eye, as it is always found
Doth fat the horse; his foot doth fat the ground."*

R. Watkyns (1662)

A pump scheme is run as a partnership between the licensee on the one hand and the tenants on the other. The terms of this partnership are laid down in the Nile Pumps Control (Blue Nile Tenancies) Regulations, which should be studied. The general basis is that the licensee provides the water, and the tenant the labour; the tenant takes the crops grown in rotation with cotton, and the profits from the cotton are shared between the partners.

First of all the licensee is responsible for providing for the necessary land. If, as is usual, it is not his own property, he must arrange with the owners, either Government or private individuals, for a lease co-terminious with pumping licence. He must pay the rent and also the land tax.

He must buy and instal the pumping-plant, dig canals and drains, instal regulators, bridges and field outlet pipes, level and clear the land, erect any buildings that are necessary and buy weighing machines. These are capital charges, and he is responsible for their maintenance, and must bear the best cost of depreciation.

He must keep the pumps running, supplying the necessary mechanics, fuel, spares, etc., and ensure that there is enough water available for all the crops in the rotation. The work of the tenants requires supervision, and for this he must provide water watchmen, agricultural supervisors, agricultural sheikhs, and, if he does not do it himself, a manager. Any other administrative work, such as storekeeping, is at his expense. He must keep accurate accounts and pay out to tenants their share of the cotton proceeds.

The foregoing are wholly the responsibility of the licensee. Some matters in connection with cotton are the joint concern of the licensee and the tenants. These the licensee is obliged to carry out and pay for, but the cost can be recovered in part from the tenants. The main item to be treated in this way is the marketing of the cotton crop,

including such things as provision of packs, twine, collecting-centres, transport, ginning, baling, insurance and marketing. Another item treated in this way is the control of heavy weeds, i.e. sedge and "ankoj". In fact, any measure to improve the cotton crop from which the licensee and all the tenants benefit and which is not specifically an obligation of either can be carried out and financed by this method. An example is the provision of fertilisers on Government Schemes for the cotton crop, but not, be it noted, for the dura crop, which is specifically the tenant's responsibility.

There is a third group of items which are wholly the responsibility of the tenant, but which the licensee carries out nevertheless, either of necessity or from choice, and recovers the cost in full from the tenant. For example, of necessity he purchases cotton seed and distributes it to the tenants; and from choice he carries out the ploughing to ensure that it is in fact done. "Abu ashrens" are normally dug by the licensee, but the cost can be recovered from the tenants.

The licensee is responsible for compliance with the law on agricultural matters within his scheme. It is he and not the tenant who is liable to prosecution for breaches of such laws as the Nile Pumps Control Ordinance and the Cotton Regulations, though of course non-operation by a tenant would be a reason for eviction.

The minimum legal duties of the licensee have been outlined briefly, but that is not enough, and the licensee who does no more is not only neglecting his duty as a privileged member of the community, but also harming his own interests. A scheme is a partnership, and cordial relations between the partners is essential. The tenant can be troublesome partner, especially if he thinks that the licensee has no interest in the scheme beyond the money he takes out of it, but his co-operation is necessary, and nothing is so conducive to the smooth running of a scheme than a contented tenantry.

On too many schemes all the management's efforts are directed to the cotton, and the other crops are neglected though they are just as important to the tenant. On Government Schemes on the other hand, as much supervision is

given to the dura crop as to the cotton; tenants are helped and encouraged to obtain fertiliser and seed of good strain, and all seed is treated against smut.

The licensee's interest, however, should not stop at agricultural operations. He should live on the scheme, be the trusted and ever-present friend and counsellor of all his tenants, and by organising and participating in other activities, do something to galvanise the moribund villages. The personal factor must inevitably be missing from Government Schemes, but scheme managers are given every encouragement to take an interest in the general life of the community, and an example has been set by the founding of welfare funds to which both parties contribute, agricultural shows, tenants' clubs, and other activities.

One of the greatest obstacles to the development of live communities on the schemes is the absentee licensee. Little can be expected from managers with limited powers and often even more limited ability. How many licensees live on their schemes? Perhaps three on the whole White Nile.

15. THE TENANT

"The first Booke containeth a communication wherein is proved...in what manner Tenants ought to behave themselves towards their Lords, in respect of their tenures".

John Norden (1618)

Government Schemes are intended to provide an alternative livelihood for persons whose land has been submerged by the Jebel Aulia Dam and the allotment of tenancies in them normally depends on the ownership of such submerged land. It is a complicated matter and is administered by the District Commissioner and need not be further discussed here.

On Private Schemes, however, it is relatively straightforward, and the system has been embodied in the Nile Pumps Control (Blue Nile Tenancies) Regulations. The allotment is made by a joint board consisting of the District Commissioner, the licensee or his representative, and a representative of the local administration.

Complaints are frequently heard that tenancies are held by men who are entitled to them, particularly friends and relatives of the licensee from outside the district. Unfortunately, this is sometimes true, but in most cases it will be found that the allotments were made before the Regulations became law, and in any case it was not always possible to find sufficient local people willing to take up tenancies, though they often come forward later, aggrieved by the prosperity that they have refused.

Under the Regulations, allotment is based on the ownership of land within the boundaries of the scheme, so that the land-owner may be entitled to both rent and a tenancy. First preference goes to men who own an area equal to, or greater than, the area of a tenancy, but a man who does not wish to become a working tenant himself may nominate a substitute. In practice, of course, a piece of land is seldom found to belong to one man, but to the numerous heirs of the original owner. The heirs may then agree among themselves for one of them, or a nominee, to take over the tenancy, but if, as often happens, they fail to agree, one of them is selected by the joint board. If a man owns a large area of land, he may be allotted tenancies in proportion, but of course tenancies cannot be allotted in fractions, and with tenancies of fifteen feddans ownership of twenty-nine feddans, for instance, would entitle to one tenancy only. If all the tenancies to which a man is entitled are, in the opinion of the board, more than he can efficiently manage, he may nominate acceptable substitutes for the surplus tenancies. Similarly, if a group of heirs own land greater in area than one tenancy, the tenancies may be divided among them or their nominees.

After the owners of plots of land as big as a tenancy have been satisfied, the remaining tenancies are divided as far as possible among persons who own land in the scheme of area less than a tenancy. If, after every private land-owner involved has been allotted a tenancy, there are still some left over, they are allotted to persons with no land qualifications but they should be normally resident in the "omodiya" (unit of local administration) within which the scheme is situated.

These conditions effectively safeguard the interests of the local people and prevent such abuses as the importation of tenants from other districts. There are, however, some provisions explicit or implicit in the Regulations which need emphasis, because they are contrary to local ideas of what is right and proper. The joint board is not bound to allot a tenancy to a man who owns sufficient land to give him a claim, or to his nominee, if he is considered unsuitable, e.g. a tenancy would not be allotted to a man who had previously held one on another scheme and been evicted for bad farming. A tenancy is allotted to one man, and to one man only. He may be the representative of a family or the nominee of a right-holder, but he alone is responsible for the tenancy, and nobody else has any concern with it. He may resign if he wants to, but as long as he is a good tenant he cannot be evicted against his will on the demand of the family or right-holder, who may want to change him because of a quarrel or some other reason. If after allotment a piece of land within the scheme is sold, the new owner cannot claim the tenancy that goes with it, but must await the death or resignation of the selected tenant. A tenant must work the holding himself and live on the scheme. The absentee tenant is as prencious as the absentee licensee, and tenants living in Omdurman and drawing their profits cannot be tolerated. A man who resigns from his tenancy, resigns his claim to it at the same time, and he cannot have it returned to him on demand. Many people resigned their tenancies when cotton prices were low, and when they rose again returned and demanded their tenancies back on the grounds that the men who had replaced them had lesser rights. They did not realise that possession of a tenancy, combined with a satisfactory cultivation record, confers a greater right than ownership of all land, submerged and unsubmerged, between Kosti and Jebel Aulia. In farming it is a case of "sana asal, sana basil",^X and the moral is, "If you have a tenancy, keep it".

On Government Schemes a tenancy is allotted for one year only, but normally it is re-allotted from year to year. Unless a tenant farms badly, he has security of tenure, and the tenancy will pass to his son on his death.

Closely linked with the allotment of tenancies on new schemes is the question of filling the vacancies which occur later, and this is discussion in Section 20.

^X Literally, "one year honey, one year onions", you must take the rough with the smooth

In general, the tenant is bound to grow such crops and by such methods and at such times as may be ordered by the licensee or manager. This may seem harsh, but discipline is essential on a pump-scheme, and water-control would be impossible if every individual tenant grew what crops he liked and took water when he liked. In any case, cropping to order is not unique, and in most countries of the world, there are either economic or statutory penalties against the farmer who grows what he likes instead of what he is ordered. Some freedom of choice, however, is desirable, and on Government Schemes it is allowed on the free feddan and on the lubia area.

On Government Schemes the conditions of tenancy are laid down in the tenant's agreement.

The tenant is responsible for all pre-sowing operations, ploughing, ridging, cultivation, "taqtiya", weeding, distribution of fertiliser, and so on, though ploughing and ridging for cotton are done for him and he is charged the cost in full. He has to find his own seed, but in the case of cotton he receives it from the licensee and pays for it. He has to sow, re-sow, hoe, thin, water and harvest crops, and in the case of cotton he has to pull out the plants by the roots and destroy them and the debris by fire. He is bound to hand over the management at the collecting-station, all the cotton he picks, receiving in return forty per cent of the net proceeds; but the other crops are wholly his property.

He is entitled to receive free of charge water for his cotton crop and for an area of other crops equal to the cotton area. He has to keep his "abu sittas" and the lengths of "abu ashrin" opposite his plots clear weeds and in such condition as to permit the free flow of water without breaks. The "dowran" may be either the joint responsibility of all tenants on the "abu ashrin", or only of the tenant at the tail. Each tenant is obliged to keep the lengths of road opposite his plots clean and fit for wheeled traffic. On Government Schemes tenants are not compelled to bale out their "abu ashrens" after each watering, but instead, they have to contribute part of the cost of mosquito control by larvicides.

If a tenant fails to carry out any agricultural operation effectively or punctually, he may be punished by the agricultural court, or the management may arrange for the work to be done and recover the full cost from him.

If for any reason there is a change in the tenants in the course of a season, the outgoing tenant has the right to claim the value of the work he has done from his successor. The valuation is assessed by a board consisting of one representative of the outgoing tenant, one representative of the incoming tenant, one representative of the local government and the local manager.

A tenant must live in a village within or adjacent to the scheme. Most schemes have "qozes" (saud hills) near to them, and they provide the healthiest and most popular sites for villages. In fact, however, the tenant usually lives in his village only from the beginning of the rains until his dura is harvested; he then moves with his family and animals on to his dura patch and lives in a straw hut. To abolish villages and have each tenant build his house on his tenancy cannot be recommended. Besides taking up valuable farming land, life on the tenancies during the rains would be both unhealthy and uncomfortable.

A tenant may not leave the scheme for more than a day without informing his sheikh, and may not be absent more than a few days without permission from the manager. This may sound like undue interference with the liberty of the individual, but experience has shown its necessity. A tenant may be absent on the day that he is due to take water, his animals may be found grazing in the cotton and he himself cannot be found; he may even go away for weeks or months and make no adequate arrangements for his work to be carried on during his absence. In fact, during slack seasons, if a tenant is not behind with his work, leave of absence is never refused.

A tenant may not depute his responsibilities to anyone else, sub-let his holding, make a partnership or mortgage his crops. He is personally responsible for everything that happens on his holding and answerable for it to the agricultural court. It is an almost invariable rule on the White Nile that anything done by a deputy is done badly. More-

over a tenancy cannot support more than one family; if there is a deputy, he cannot earn a decent livelihood unless the tenant has other sources of income and is keeping more needy persons out of a holding. There are few tenants who never employ any labour, they and their families doing all the work themselves. On other holdings, all the work is done by hired labour, and the tenants and their families never do a hand's turn. Most tenants, however, do some of the work themselves as well as employing extra labour. Where are the large numbers of children and relations that everybody claims to have? It is all a matter of pride and prejudice, but it must be admitted that the employment of extra labour at the rush periods is not unreasonable for most families.

Except perhaps to build a house, a tenant needs no capital. Tools are issued to him against later payment, and he receives loans to help him establish his first crops. Thereafter he need never be in debt unless he wants to.

16. THE MANAGER

"Husbandry does not only depend upon the Methods of Cultivating Land... : for that is the least part of a Farmer's Business."

—Letter To R. Bradley (1729)

In the case of Government Schemes the licensee is the White Nile Schemes Board, which runs the pump-schemes and Abdel Magid in conjunction with the Irrigation Department. The pump-schemes are under the control of a Senior Inspector of Agriculture, and the manager in charge of each scheme is either an Inspector or an Agriculturist, all seconded from the Ministry of Agriculture.

As the local agent of the Board, the manager is responsible for the performance of the licensee's duties on his scheme. No money may be paid out or stores issued or ordered without his authority, and he has to submit statements of accounts and stores monthly. The staff he needs to assist him depends on the size of scheme, but on the large schemes there is usually a book-keeper and store-keeper. A scheme cannot afford extreme specialisation, however, and both these officials must be prepared to carry out other duties. The book-keeper, for instance, does all

the clerical work and keeps records, and the store-keeper is in charge of the cotton market, and both of them should on occasion undertake work out on the scheme and be able to act for the manager in his absence.

The most important part of the manager's work is the daily inspection. On small schemes it is possible to inspect every part of the scheme three times a week, but on the large schemes only once a week is possible. Each sheikh should be present when his area is inspected, and the route of the inspection should be varied so as to foil the sheikh who would like to turn out on inspection days only. The whole crop cannot be seen from the road, and every plot cannot be inspected in detail, but the manager should walk through a few plots every day. If this is done, outbreaks of pests and diseases are more likely to be spotted in their early stages, and in other ways it is surprising what a close inspection may reveal. Sins of omission and commission should be pointed out to the tenant on the spot—if he is absent that is another back mark against him—and a check made later that they have been dealt with by the agricultural court.

Pumps, canal and double "abu ashrin" are the responsibility of the irrigation engineers, and the responsibility of manager for the control of water starts at the field outlet pipe. The irrigation engineer is responsible for letting water into the "abu ashrius" in accordance with a weekly indent prepared by the manager.

Ploughing needs much supervision. The teams should frequently be seen at work and only good work paid for, and regular inspections should be made at the bull yards to ensure that the animals are being properly fed and are in good health.

The manager is president of tenants' council, but though he should attend all the meetings, he should not normally preside, but leave it to the head agricultural overseer. Weekly meetings of the council provide a good opportunity for discussing the progress of work, distributing praise and blame and issuing orders. The manager is chairman of the local welfare fund committee and should normally be president of the tenants' club.

The manager is the hub of the scheme, and his success depends on the extent to which he can combine firm justice with good personal relationships. He should endeavour to know all his tenants personally, though on the larger schemes this may take longer than is allowed by the average tour of duty. He should take an active interest in everything that affect the life of the scheme and by example persuade others to do likewise, but at the same time he should avoid getting involved in the quarrels, political tribal or family, that bedevil every scheme. On some schemes there is a scheme council dealing with matters which do not concern the tenants' council, such as wells, latrines and midwives, and the manager should not only be an active member of it, but president of it. Nothing that happens on the scheme is too insignificant for his interest. The functionaries of the local administration require tactful handling. As such they have no concern with the management of the scheme, for only tenants and White Nile Schemes Board staff have any say in it, but they represent powerful interests and may have considerable influence over the tenants. Their co-operation is, therefore, worth having. X

17. ACCOUNTS

"The second Booke... concerning the estate of a Manor of the parts and profits thereunto belonging, and how the Lord of a Manor ought to deale with his Tenants."

John Norden (1618)

The general procedure for accounting is laid down in the Nile Pumps Control (Blue Nile Tenancies) Regulations and is the same for all schemes, Government and Private. For each season there are three principal accounts, the Joint Cotton Account, the Tenants' Share Account and the Licensee's Share Account: and tenants' individual accounts may be kept if necessary.

X The above is the opinion of the writer. For further material on this subject, it is suggested that those interested should refer to the report of a Commission appointed to review the work of "omodiya" and Village Councils in the Gezira. See also "A Directive on Devolution" issued in April, 1951.

Joint Cotton Account

Into this account are paid the gross proceeds from the sale of the cotton crop, including lint, scarto and seed, and of old cotton packs, and the fines that are levied by the agricultural courts. Chargeable against this account are the following items :-

- (a) cotton-marketing expenses, including cost of running collecting-centres, packs and repairs to packs, twine, transport ginning, baling and insurance.
- (b) cost of materials and operations which benefit both the licensee and tenants and which are the specific obligation of neither, such as the control of heavy weeds, sprays and fertilisers for cotton, and payments made to tenants for root-pulling.
- (c) contribution to welfare funds on Government Schemes; at present this accounts to one half per cent of the net divisible balance of the Joint Cotton Account.

The balance of this account is passed to the Tenants' Share Account and the Licensee's Share Account in the proportion of forty per cent to the former and sixty per cent to the latter.

Tenants' Share Account

The main item of revenue to this account is forty per cent of the net divisible balance of the Joint Cotton Account. Other minor items include payments made by tenants for tools and extra ploughing and receipts from the sale of cast bulls, these having originally been paid for from this account.

Against this account is charged the cost of anything which is the responsibility of the tenants, but which is done on their behalf. It should be emphasised, however that anything dealt with in this way must benefit all tenants equally. Under this head comes ploughing and ridging, etc., which includes the cost of ploughs and spare parts, new bulls, feeding stuffs (unless contribution in kind by the tenants) and ploughmen's wages. On some Private Schemes

the tenants are charged a flat rate and detailed ploughing accounts are not kept.

A stock of tools required by tenants is kept, including such things as hoes, spades, spring balances and "abu sitta" pipes. When these are purchased, the cost is charged against this account, and when sold the price is paid into it again.

Part of the cost of mosquito control is charged to this account and credited to the Public Health Department.

Advance payments made to tenants to help them establish their cotton crop may be recovered from this account, provided the advances are equal for all tenants. On Government Schemes, however advances are no longer paid and the tenants finance their current crop from the proceeds of the proceeding crop.

After the expenses have been paid, the balance is available for distribution to tenants in proportion to the weight of seed cotton they have handed in. This is paid to the tenants at a flat rate per kantar, no difference being made for grade.

The system adopted by the White Nile Schemes Board is as follows: Before picking starts an estimate is made of the balance of the Tenants' Share Account that will be available for distribution to tenants. On this basis is announced the price per kantar that will be paid to tenants. This price is not paid out in one sum, but in instalments spread over the year and tenants' councils are consulted as to the amounts and times of payments. The first instalment is paid when the tenants hand over their cotton and later instalments when they most need money, for example in August and September for establishing next season's crops and in November for harvesting the dura crop. This is meant to help the tenant who wants to keep out of debt, but debt is so deeply ingrained in White Nile traditions that few have yet shown signs of wanting to. In practice, fluctuating markets may make an early estimate of produce impossible, and while a first instalment is paid on taking over the cotton, the announcement of the total payment has to be postponed.

It is clear that as neither the yield, nor the sale price nor the marketing expenses are known, the estimate can never be accurate and a reserve fund becomes necessary. If the sum paid out to tenants turns out to be less than the amount actually available, the surplus is paid into the Tenants' Reserve Fund. If, on the other hand the money paid to the tenants proves to be more than is realised, the deficit is taken out of the Tenants' Reserve Fund. The reserve fund, therefore, permits the tenant to be told beforehand exactly how much he is going to receive for his cotton, but this is not its most important function. The tenant is improvident and quite incapable of saving and a drastic fall in the price of cotton would find him with nothing in his pocket to fall back on. The Reserve Fund, however, can be used to save money for him by absorbing surpluses in years of high prices and subsidising cotton payments in years of low prices. It is important that the functions of the fund be understood, and also the fact that the money belongs to the tenants only cannot be used in any other way.

On Private Schemes a small payment on account is usually made when the tenant hands over his cotton, and the balance in one sum when the crop has been sold.

In transactions that affect all tenants on Government Schemes, the Joint Cotton Account and the Tenants' Share Account are communal. When the original allotment of tenancies was made, it was entirely a matter of chance whether a man obtained a holding on the best soil or the worst on the scheme. The communal accounts provide a certain degree of compensation for this. The cost of such things as ploughing and fertiliser is not contributed equally by each tenant, but in proportion to the quantity of cotton he produces. Thus the man on good soil subsidises his brother on poor soil, but unfortunately the good tenant subsidises the bad one as well. The latter, however, is gradually being eliminated.

Tenants' Individual Accounts

If there are many transactions with individual tenants, as distinct from transactions involving every tenant equally, it is worthwhile opening an individual account for each tenant. These transactions include such things as payments

by tenants for tools, extra fertiliser for dura, extra ploughing, and wages of labourers put on to a neglected tenancy. On Private Schemes, loans are dealt with in this way, as they are given births, marriages and deaths and therefore vary from tenant to tenant. Every tenant is issued with a note-book in which the transactions are recorded.

Licensee's Share Account

Into this account is paid sixty per cent of the net divisible balance of the Joint Cotton Account. From it the licensee has to finance his obligations as a partner, and may advance money to tenants, and the surplus is his profit.

On Government Schemes, their revenue side of the White Nile Schemes Board's budget is almost entirely from this source. Other minor receipts are from such things as house rents, sanitation rates and water rates. On the expenditure side, the most important items are cost of pumping, including maintenance of plant and canals, etc., salaries and wages of the Board's staff and sheikhs, maintenance and depreciation of buildings and equipment, recurrent land-leveling, forests and gardens, and office expenses.

Welfare Funds

The accounts of the Welfare Fund are kept by the local treasurer, but require supervision by the book-keeper. Each fund has a separate banking account, and cheques have to be signed by both the Senior Inspector of Agriculture and the local treasurer. The financial year runs from July to June and a statement of accounts and a proposed budget have to be submitted annually to the trustees.

Explanation of Accounts

The responsibility for authorising and allocating expenditure lies with the manager, but that does not mean that all the book-keeper has to do is to add up the number of mil-liemes spent. Any elementary schoolboy can do that, and it is not enough. For the efficient running of a scheme the expenditure requires analysis. For example, what was the cost last season of ploughing per kantar of cotton produced? How did it compare with the previous season? If higher, what was the reason—yield per feddan, wages, sesame cake,

spare parts, disease among the bulls? That is the sort of question to which the manager has a right to an accurate and immediate answer. For efficient management, costing figures should be available to him every day and not have to be dug out of a Khartoum office. This requires a complete understanding of the accounting system and the management of the scheme on the part of the book-keeper.

Not only do accounts have to be made clear in a detailed way to the manager, but also in a simple and general way to the tenants. Tenants are entitled to see the Joint Cotton Accounts and the Tenants' Share Account, though not the Licensee's Share Account, but are unable to comprehend them in their usual form. A simplified form of these accounts should be prepared when they are closed for the season and explained to the tenants through the tenants' council. The ignorance of such matters among tenants and those who presume to speak for them is abysmal and is the cause of the sporadic waves of dissatisfaction that spread among them. It is worth while plugging away with explanations in the hope that eventually they will be understood: when a howling mob surrounds the office it is useless to wave a sheaf of audited accounts at them.

18. STORES

"A good husband will always have his Forkes and Rakes made ready in the winter before."

Thomas Tusser (1571)

On most of the Government pump-schemes, stores are in the care of a store-keeper working under the manager. Storekeeping is closely linked to accounting, and in fact there are three sections of stores, corresponding to the three principal accounts, Joint Cotton, Tenants' Share, and Board's Share. To avoid confusion the sections should be stored and recorded separately. For example, hoes for sale to tenants must be differentiated from hoes for use in the office garden, as the former comes under Tenants' Share Account and the latter under Board's Share Account. Pump stores are the responsibility of the irrigation engineer and are not dealt with in this section.

Joint Cotton Account Stores.

The chief items under this head are stores required for dispatching cotton to the ginnery, such as packs, twine, ne-

edles, lamp-black, and payment slips. Also included are any materials for operations financed by this account, such as fertilisers.

The cotton packs used at present are of the "Tokar bale" type. Each pack consists of two five pounds sacks sown together, and they are made locally under the supervision of the store-keeper. This work should start immediately after the rains. As soon as the empty packs are returned from the ginnery at the end of the season, they are examined, and those unfit for further use sold locally: there is always a sale for them, if only for charcoal. Those that are worth it are repaired straightaway. An estimate is made of the number of new packs required for the following season, and an order for them placed immediately and not left until next season's bolls are opening.

Tenants' Share Account Stores

Stores held on behalf of the tenants under this account are ploughs and their spare parts, feeding-stuffs for ploughing tenants, and toriyas', spades, root-pullers, spring balances and pipes for sale to tenants. Items for sale to tenants should never be issued on loan and never accepted back after issue. A tenant who leaves the scheme can sell his tools to his successor.

Root-pullers are liable to break in use; a tenant cannot postpone the work until his puller is repaired, and it is unfair to expect him to buy a new one or lend him one from store and sell it later as new. It is worth while, therefore, inspecting all pullers every year when pulling has finished and sending broken ones off immediately for repairs. Even so, there are bound to be some breakages at the critical time, and a few can be set aside for loan in such circumstances; but these pullers should never be sold after return.

Board's Share Account Stores

Under this head come the equipment and materials required by the Board for carrying out its obligations. Here it is necessary to differentiate between consumable and non-consumable stores, though it is not easy to draw a clear-cut line between them. Consumable stores are used once only

or have a short life, such as cotton cake, paper, pencils and inking pads. Such items have to be purchased every year and they are included in Section II of the budget. Non-consumable stores are used over a long period, such as "gassabias" and typewriters. New ones are purchased as they wear out and their cost is treated as capital expenditure, usually under Section III of the budget. But what about such things as pens which may last either months or years ?

Consumable stores include office materials and feeding stuffs for the levelling bulls. The board does not come under the Government free service system and stationery is ordered as required. Nevertheless it is convenient to have an "establishment" showing normal annual requirements as a guide to what is reasonable consumption, and to place not more than two orders each year.

Each scheme has an establishment of non-consumable stores including such things as office desks, resthouse furniture, cars and gassabias. Smaller items can be replaced by purchase under Section II of the budget, e.g. 'toriyas', but larger items have to be budgeted for under Section III.

Stores can be transferred from one section to another provided their money value is transferred at the same time. For example, a stock of simsim cake has been purchased for ploughing bulls and the cost debited against Tenants' Share Account. Some of the cake is taken to feed to bulls that do the land leveling and this is the Board's responsibility. The cost of this cake is therefore taken from the Board's Share Account and paid into the Tenants' Share Account.

The best way to record receipts and issue of consumable stores is to keep a card for each item, no matter what account it comes under. In the case of plough parts it is helpful to draw a small picture of each part at the top of its card. A summary of receipts and issues has to be submitted to the head office each month. Separate cards need not be prepared for each item of non-consumable stores, but the establishment should be kept up to date and always available.

At the end of every year a stock-taking has to be made of every item, consumable and non-consumable, and surplus-

ses and deficiencies accounted for. At the same time non-consumable stores are examined and if unfit for further use, certified accordingly. Boarded articles should be sold for what they will fetch, as there is no point in cluttering up the stores with junk.

An important part of the store-keeper's work is running the cotton collecting centre. To keep hundreds of packs flowing through everyday requires foresight and organization. The most important point is to have everything ready long before opening day. Sacking and string for repairs, books, forms, lamp black, stencils, carbon paper and pencils are all required. The tare needs to be checked (usually thirteen rolls), the weighing machine has to be checked by an Inspector of Weights and Measures and perhaps a "raku-ba" has to be built. A list of payment to be made for every weights of cotton likely to be brought in saves calculation on the spot and can most easily be prepared from a graph.

The essence of storekeeping is foresight and the good storekeeper cultivates the habit of always looking a year ahead. Every occasion on which stores are required and none found represents a failure on his part. At the same time he should avoid submitting frequent small orders for new stores, but try to restrict them to a few large ones each year. The store-keeper can be a most valuable lieutenant to his manager and it is a mistake to think that his is a job any fool can do. It requires foresight, accuracy, organising ability and integrity.

19. RECORDS

"A manor should be surveyed and viewed, butted and bounded on every part..... so that it may be knowen an hundred years after, and forever what manner of landes and how many acres every man had to his house at that time, and where theyly."

John Fitzherbert (1523)

The keeping of records is much neglected. What records there are, are buried in the files and often in the wrong ones. The deficiencies have to be supplied from memory, and memory is too dependent on convenience to be reliable. Records well kept, easily accessible, and showing at a glance comparisons with previous years, are indispensable for efficient management. The most valuable records are of cropping and of tenants.

For cropping records the first essential is to give every

plot on the scheme a number and to mark it on a plan. It is worth emphasizing that the number of a plot must never be changed and that the number must never be given to another plot. This may seem obvious enough, but much confusion has been caused by changing plot numbers when the canalization has been altered, or, when plots are abandoned, transferring their numbers to new plots brought in to replace them. Every year the following facts should be recorded for each plot: the crop grown, and if more than one, their relative positions, the yield (in practice the yield of cotton only is known), and any special treatment, such as fertiliser. The most convenient way of recording this information is on a plan, a fresh one being prepared each year.

With this information available the manager can study and analyse changes in his scheme yields. How does the cotton that received fertiliser compare with the cotton that did not? Is a fall in yield universal over the whole scheme or is it restricted to certain parts of it? Is a poor yield on a particular tenancy due to the fact that one of the plots is less fertile than the others compared in the tenancy? Questions such as these can be answered only if detailed records are available. Applications for exchange of land on private schemes would be much more sympathetically treated if evidence of this kind could be produced. Furthermore, well-kept records are invaluable for research, and we still lack sufficient long-term results on which a farming system for the district can be based with real confidence.

Alongside the cropping records should be kept a record of changes in tenants. First of all, for each tenancy the basis of allotment should be stated. On Government Schemes a tenancy may be earmarked for a particular sheikhship or 'omodiya', and if this is the case, it should be recorded, as if there is a change the new tenant will normally have to come from the same sheikhship or "omodiya". If the allotment is on the basis of ownership of land within the scheme, the plot of the land in respect of which the allotment is made and its area should be recorded. Every time a change is made, the reason for it should be recorded, e.g. eviction, death or resignation, and also the basis of the selection of a new tenant, usually relationship to the previous tenant. If this information were readily available, much argument in the hot days of May would be avoided and justice always done.

20. TENANTS' COUNCILS

On large schemes it is quite impossible for the manager to deal directly with each of say five hundred tenants; intermediaries are necessary. The tenants are therefore divided into groups of twenty to thirty, and an agricultural sheikh is appointed over each. The grouping of tenants is not haphazard, and to avoid friction every tenant within a sheikhship should belong to the same section, sub-section or sept of the tribe, as the case may be, and they must all be on the same "abu ashmins".

The sheikh is one of the group and he is appointed by a combination of popular election and selection. He has to act as intermediary between the manager and his tenants. On the one hand, he has to pass on orders and explanations from the manager to the tenants and summon defaulters to the court, and on the other he has to express the tenants' point of view to the manager, submitting suggestions and complaints. He receives a wage, extra land for dura if available, and a bonus. Originally the bonus was based on the cotton yield of the sheikhship, but this was unfair to sheikhs on poor land, and it is now paid in proportion to the standard of his work up to a maximum of twelve pounds per year.

Over the sheikhs is a head sheikh, called a "samad", who also is a tenant. Six or seven sheikhs is a convenient number for one "samad", but there should never be more than nine or ten. If there are more, the scheme is divided into two or more sections, each with its own "samad".

The task of a "samad" or sheikh in serving two masters is not an enviable one, and for allegories there is the choice of horns, millstones and the Straits of Messina. They must have the respect of the tenants, but if the choice were left to popular vote, the mantle would fall on a man who would leave them in peace. Hence the necessity for the combination of election and selection in their appointment. As executive agents of the manager, passing on his orders and seeing that they are carried out, they have been fairly successful, though needing much supervision, and any sheikh who does not part of his duties moderately well is worthy of his hire. As propagandists, however, spreading explanations of scheme organization and of the various agricultural opera-

tions, they have been a complete failure, and few tenants yet understand the reasons for root-pulling for example. It would be unrealistic, however, to place all the blame for this on the sheikhs; it must be shared by the tenants, too many of whom have a mentality of very low capacity.

On each scheme there is a tenants' council, or more than one if the scheme is divided into sections. The manager is the president, and the "samad" is chairman, and the latter should normally take the chair. The members are the sheikhs and a variable number of tenants' representatives, and a clerk is required. A tenants' representative may represent the tenants of one or more villages or one or more sheikhships. The minimum qualifications are that he must himself be a tenant and have a good cultivation record, and he is appointed by a combination of election and selection. It is a fundamental principle that nobody may have a say in the running of a scheme unless he has a direct financial interest in it, therefore nobody may be a member of a tenants' council unless he is either a tenant or a representative of the White Nile Schemes Board. An "omda" (administrative official), for example, may be a member as a tenants' representative, provided he has the requisite qualifications, but not as an "omda". It is fatal to allow the local government to interfere in the administration of a scheme, as it is not its function, and the interests of the two do not coincide. Moreover, the local government is still living in the last century, while pump-schemes are a product of the twentieth century and demand different standards.

One function of the tenants' council is liaison between Board and tenants. The council is invited to express the tenants' views on such matters as the timing of cotton-payment instalments and the application of fertilisers. The manager explains such matters as the annual accounts in the hope that the information will percolate through to the tenants, discusses the progress of work and issues orders, and the members bring forward complaints and suggestions.

A second function to the council is to sit as an agricultural court and in this capacity it meets once a week. The court has jurisdiction over tenants only, and only in respect of agricultural offences. Other persons resident on the scheme, and criminal offences are dealt with in the normal

courts. In accepting a tenancy a man accepts the jurisdiction of the agricultural court and if he does not wish to accept the latter he must resign the former. Any breach of a condition, whether expressly stated or implied, of the tenants' agreement, is an offence. The most common offences are water-breaks, dirty "abu ashrens", animal trespass, and failure to carry out an operation such as weeding effectively or in time. Such misdeeds are indictable because they influence the running of the scheme and therefore affect all the other tenants and the other partner. If there is a water-break, water is wasted, which would otherwise be applied to other tenants' crops. If weeds are not hoed, they may form a focus for the infestation of neighbouring tenancies, or if perennial weeds become too firmly established, the land may have to be abandoned, leaving one less tenancy for the community and an increase in overhead charges. The fine imposed is therefore partly compensation, though inadequate, to the other tenants and the other partner for the damage done to their interests, and partly punishment to discourage future misdemeanours.

The tenant is summoned before the court by his own sheikh, who gives the court, in the tenant's presence, details of the alleged offence. The tenant is allowed to speak in his own defence and to call witnesses. The decision of the court is by majority vote, but the sheikh of the accused does not exercise his. The punishment may be a fine, an order for the fault to be rectified by paid labour at the accused's expense, or merely a warning accompanied by a time limit for the fault to be rectified. Fines are paid into the Joint Cotton Account, so that sixty per cent goes to the Board and forty per cent to the tenants—including the man who pays. The tenant has the right of appeal to the Senior Inspector of Agriculture.

If a tenant damages another tenant's crops, the court can not only fine him, but assess and order damages to be paid. For example, a man may kill his neighbour's lubia by allowing a water-break and flooding it, or he may allow his animals to graze his neighbour's cotton. In the case of cotton, damage is sustained by both the tenant and the Board, and damages have to be paid in the proportion of four to the former and six to the latter. If the damage is done by a person who is not a tenant, the case has to be referred to

the normal courts. This has to be done frequently in cases of animal trespasss, but the courts tend to be much too lenient.

If a tenant refuses to pay a fine he is liable to eviction. Anomalous though it may seem, the fine can, however, be enforced through the "omda" and in such cases it is doubled. The "omda" may not cancel, reduce or increase the fine, his duty being restricted to collecting it and paying it into the account.

At the end of every season a special meeting of the tenants' council is held at which the work of each tenant is reviewed, attention being given to the number of court convictions and the records of previous years. On this basis the council makes recommendations to the White Nile Schemes Board that :

- (a) the tenant have his tenancy renewed for another season; or
- (b) the tenant have his tenancy renewed for another season, but be warned that his work must improve; or
- (c) the tenant have his tenancy renewed for another season, but be given a final warning that if his work does not improve he will be evicted at the end of the following season; or
- (d) the tenant be evicted.

The local administration is then consulted as to filling vacancies caused by evictions, deaths, resignations or other reasons, and recommendations made. At the same time, changes that have occurred during the season are confirmed. Appeals against the recommendations of the council are heard by a final appeal board consisting of District Commissioner, Senior Inspector of Agriculture and Nazir of the Dar Hassaniya. It should be noted that the manager has the right of appeal to this board against what he considers to be an unreasonable recommendation. The recommendations of the tenants' council, as amended by the final appeal board, are accepted by the White Nile Schemes Board and there is no further appeal.

There is no law to be consulted on evictions and the filling of vacancies. Every new combination of circumstances has to be considered on its merits, and the decision sets a precedent for future cases; thus case law is being built up. Evictions are relatively simple, but the filling of vacancies poses some pretty problems and leads to long and tortuous arguments. Precedents are readily quoted when favourable, but are not easily found in the records when unfavourable. It is worth while quoting some rulings which have been arrived at in this way and which are now generally accepted.

A tenancy is automatically renewed for another season unless the tenant is expressly evicted. A tenant may not be evicted for breaches of the tenants' agreement, interpreted in a wide sense or in conditions expressly stated in the allotment of the tenancy to him, e.g. tenancies held in trust. This covers such cases as demands for eviction by people who consider they have better rights. Animal trespass, if bad enough, is by itself sufficient reason for eviction.

When a tenant is evicted, the tenancy is normally allotted to a relative, but after a maximum of three members of a family have been evicted, the tenancy is allotted outside the family. Three chances for a family to find a steady tenant are considered sufficient but in particularly bad cases an allotment outside the family may be made after the first or second eviction.

When a tenant dies the tenancy normally passes to his eldest son, and the Board cannot be bound by the wishes of the deceased as to its disposal. If the son is not old enough to accept the responsibility, it is allotted to a relative, usually the deceased's brother, to be held in trust for the son until he becomes old enough to manage it himself. If the deceased leaves no son, and neither his widow nor any of his daughters is capable of managing the holding, it is allotted to a relative of the deceased on condition that he supports the family. If the widow or one of her daughters is considered capable of managing the holding, it is allotted to her, but safeguards are necessary to prevent the tenancy's passing out of the family in the event of subsequent marriage. But there are other dangers, and on one occasion when a tenancy was allotted to a widow, the holding was neglected in consequence of her annual pregnancies, and the council had to

threaten eviction as the wages of sin. If the deceased leaves two or more widows and a number of daughters out of each, precedents are valueless.

The general principles of Muslim civil law offer some guidance to problems such as these, but there is a fundamental principle on which there can be no compromise—a tenancy is indivisible.

Some idea of the number of cases that pass through tenants' council is given by the following table for the Government Schemes in the season 1947-48³:

Scheme	No. of evictions per 100 tenancies	No. of court convictions per tenancy
Um Gerr	9.9	2.7
Dueim	9.5	3.4
Wad Nimr	1.5	0.8
Hashaba	1.1	0.5
Fatisa	0.9	1.3

In the early years of a scheme the number of convictions and evictions is inevitably high, but gradually the incorrigibles are eliminated by evictions, and a scheme should settle down to figures like those of Hashaba. The high figures for Dueim are due to its exceptional circumstances.

It is sometimes argued that a tenant cannot expect justice from a body that combines executive and judicial functions, but in this the agricultural court is no different from other local courts of similar status. In any case the barrel of intelligence and integrity has been scraped to find the executive, so where is a separate judiciary to come from?

The councils vary greatly in quality. Some can be trusted to make decisions with a sense of responsibility and public spirit. Other take a view that is no wider and no more distant than the book-keeper's window on next pay day, and unless closely supervised, make the most outrageous and irresponsible decisions. In general, they are better on the older schemes and where they have had the advantage of firm supervision in their formative days. A far from negligible function is to give some continuity to the schemes, an important factor in view of the high transfer rate among managers.

As a tentative experiment in devolution, the councils have been a success, and their value was recognised in the award to Sheikh Yousif Abdulla, "samad" of the Laota section of Hashaba, of a robe of honour by His Excellency the Governor General in 1948. It would be unrealistic, however, to pretend that it is more than a very limited form of devolution. A tenants' council is handpicked, and is not a democratically elected body; the standard of tenant is so low that if it were elected it would be quite incapable of having anything devolved on it. The members do not represent the mass of the tenants, they do not even represent the elite—they are the elite. A pump-scheme cannot be run on votes, any more than an army can. All we can do is to give the selected men experience and gradually increasing responsibility in the hope that they have sufficient integrity for the public interest to be seen.

The chapter is concerned with the Government Schemes, but of Private Schemes the general principles are the same. There are differences in the composition of the tenants' councils, and the functions of the final appeal board are performed by the joint boards.

21. LIVESTOCK

It shall be good to have understanding of the ground where ye doe plant ; first, it behoveth to make a sure defence, to the end that onely rude persons and children may be kept out, but all kinds of hurtfull cattel, as oxen, kines, calves, horses, hogs, and sheep."

Leonard Mascall (1572)

The attitude of tenants to animals has been discussed in Section 7. There are always far more animals than can be adequately fed on the fodder available, and they are invariably in poor condition. Little attempt is made to conserve fodder, and when it becomes available, the animals are allowed to eat it as they wish, until it is finished. For example, when the lubia is opened to animals, it is often grazed to the ground in a week, and then there follows a period of starvation. With this population of underfed animals goes the continuous danger of damage to crops. Apart from the natural straying propensities of unfenced livestock, a tenant is not averse to driving them into the cotton—his own or preferably his neighbour's.

No actual experience is available of the number of animals that a tenancy can carry and obviously it must be variable, but an estimate can be made for average conditions. Dura, wheat, straw and lubia, can be stacked and rationed out when necessary. Hay could be made from wild grasses outside the scheme and stacked but this possibility can be ignored. Apart from this, grazing is available for parts of the year on the fallows and outside the scheme, on the dura and lubia stubbles, on the dura threshing floor and on the cotton, after picking. This can be expected to provide five months' grazing, leaving seven months' fodder to be provided by the dura straw and lubia stacks, and by the wheat straw. On this basis it would be possible to maintain about five cows or their equivalent, for example, say twenty sheep. This allows nothing for fattening or for production of milk, for which additional feeding would be required.

This can be taken as a target to be aimed at, as the maximum number of animals that a tenant should keep. The first attack should be on the donkeys, horses and camels. There are too many of them not earning their keep.

The matter is complicated, however, by the fact that not all the animals belong to the tenants. As the country-side dries up the inland herds are driven down to the river, and envious eyes are cast on the green oases of the pump-scheme. It is at this time that animal trespass becomes most serious and the stage is set for the annual contest between animal owners and management, the former trying to get as many animals as possible in, and the latter, with more or less help from the police, trying to keep them out. Animal trespass is less severe on Private than on Government Schemes, as the cattle owner and licensee may be related, or even the same man. A tenant may resist the grazing of a stranger's cattle on his land, but he is under heavy pressure to admit those of his rainland relatives. Not that there is any clear distinction between animals owned by a tenant and those owned by his rainland relatives. Ownership may not be communal, but management is, and it is for the family to decide which animals spend part of the year on the inland grazings.

It will be many generations before the Hassaniya adopt a more rational attitude to animals, but in the meantime there is a simple remedy for this barbaric state of affairs: heavy penalties for the crime of animal trespass.

There are other more insidious results of over-stocking. Every blade of grass around the scheme is grazed off and the soil loosened, by the trampling of hooves. Consequently dust storms blow for days on end, and much of the dust is deposited within the scheme, Not only does this add to the cost of canal clearance, but it gradually raises the level of the land. Eventually the land will go out of command—rises of twenty centimetres have already been recorded—and will be lost to irrigation. A local administration that could cope with this problem would indeed earn its pay. It is to be hoped that the abandonment of a large area will not be necessary to bring home the lesson.

22. PUBLIC HEALTH

"First then for the quotidian fever, you shall take a new laid egg."

Thomas Tusser (1571)

Perhaps the best indication available of the state of public health on pump-schemes is given by the following table, showing the annual death rate per hundred tenants on the Government Schemes since they opened.

<u>Scheme</u>	<u>No. of deaths per year per 100 tenants</u>
Dueim	1.2
Um Gerr	1.1
Hashaba	1.0
Fatisa	0.9
Wad Nimr	0.9

Tenants form a section of the population, that does not die of senile, infantile or gynaecological diseases, and for such a section death rate of one per hundred is indeed high. No information is available as to the causes of death, nor as to how the death rate compares with corresponding rates outside pump-schemes.

The most common diseases are malaria, dysentery, bilharzia and eye diseases—all water or insect-borne and likely to be aggravated by the conditions of life on pump-schemes. It is true that the incidence of malaria is dependent on climatic conditions, but pump-scheme conditions do contribute their quota.

Stagnant water, particularly if plants are growing in it, provide breeding-places for malaria-carrying mosquitoes. This is most commonly provided in over-watered dura crops, improperly dried "abu ashrius", and canal seepage. Over-watered dura can easily be avoided by anyone who wants to. Pools in "abu ashrius" between waterings can be prevented to the tail, where it can be baled out or oiled. The "dow-ran", of course, needs baling out or oiling after every watering. Seepage is usually due to canal banks not being wide enough, but on salty soil even well-built banks may seep. Where seepage occurs a ditch should be made along the bottom of the bank and drained at intervals into "abu ashrin" or "abu sitta". Periodic weeding of canals, canal-banks, "abu ashrius" and "abu sitta" is of course essential.

Canals and "abu ashrius" used for ablutions, or drinking, or both, are a source of water-borne diseases such as bilharzia. Wells should therefore be dug, or, if the water is too salty, filters made for canal water. It should be remembered, however, that if filters are not cleaned regularly, they become more of a danger than a protection.

Too many "abu ashrius" are used as latrines. Not only does this contaminate the water, which may be used for drinking, but the moist conditions encourage fly-breeding. That the use of "abu ashrius" for this purpose is not prevented by the provision of proper latrines is shown by the classical example of the double "abu ashrin" running alongside Dueim town. Perhaps the remedy is a form of spring trap.

23. THE LAW.

It is the duty of every pump-scheme licensee and manager to know and understand the law of the land in so far as it affects the running of his scheme. Ignorance of the law is so general as to make one wonder how far it is genuine and how far a pretence. On more than one occasion, a licensee on being informed that he was breaking the law, has actually said, "If that is the law, I do not agree with it!". Unfortunately, every man cannot be his own legislator.

This chapter deals briefly with the laws that particularly concern pump-schemes. The laws themselves, of course, should be studied, for nothing that is here written or omitted can be quoted in a court of law.

The Nile Pumps Control Ordinance 1939.

As explained in Section 2, there is not enough water for everybody, and it is therefore the duty of Government to ensure that the available water is used to the best advantage. The Nile Pumps Control Ordinance set up a Board, the Nile Pumps Control Board, with powers to control the use of Nile waters, and made it an offence to pump water from the river for irrigation without a licence. The Board can make regulations, which have the force of law, regulating such matters as issue of licences, times of pumping, rotations, and the relations between licensees and tenants.

The Nile Pumps Control (General) Regulations.

The first general regulations under the Ordinance were promulgated in 1939. They are now being amended in the light of experience gained since then.

In the new Regulations procedure is laid down for applying for, issuing, transferring, terminating and extending licences. The period of validity of licences, the times of year at which water may be pumped, and the size of pumps, are defined. Water-renting and cultivation agreements, not covered by Province regulations, are dealt with. There are sections of maintenance of pumping-plant, canalization and drainage, and a good-husbandry clause. The licensee is required to appoint a resident manager, fully accredited, if he does not manage the scheme himself; to follow a rotation of crops prescribed by the Director of Agriculture; and to submit monthly returns.

It is impossible to summarise the Regulations adequately, but the foregoing gives some idea of their wide scope. It is worth noting that under the Regulations, the following are offences punishable by a fine up to LE.50 and in addition a fine of LE.10 per day for each day during which the offence continues :

- (1) Pumping on to land not specified in the licence, or not in accordance with the conditions of the licence.
- (2) Entering into a water-renting or cultivation agreement not in accordance with Regulations.
- (3) Erecting or using pumping-plant other than that specified in the licence.
- (4) Using standby pumping-plant simultaneously with the main plant between 1st January and 15th July.
- (5) Failing to maintain pumping-plant in good condition.
- (6) Altering or moving plant without approval.
- (7) Failing to display the certificate of plant at the pump-site.
- (8) Failing to construct or maintain a proper canal.
- (9) Failing to construct or maintain proper drainage.
- (10) Failing to construct or maintain roads and bridges.
- (11) Failing to produce pump-licence and/or plan on demand.
- (12) Failing to appoint a resident manager if licensee is not resident.
- (13) Failing to notify District Commissioner of change of resident manager.
- (14) Failing to make monthly return or returning incorrect information.
- (15) Failing to follow prescribed rotation.
- (16) Failing to produce rotation plan.

The Nile Pumps Control (Blue Nile Province Tenancies) Regulations 1947.

These Regulations control the relationships between tenant and licensee on pump-schemes in Blue Nile Province on which cotton is grown by tenants on a profit-sharing basis. Practically every point in them has already been dealt with in this book, and there is no need to detail them any further.

As a piece of sociological legislation for special conditions, these Regulations are probably unique. They have not yet been in force long enough to be fully effective, but those who administer them have no doubts as to their value and much admiration for the skill and knowledge of the drafters.

The Cotton Ordinance 1926

This Ordinance amends and consolidates the law for improving and maintaining the quality of cotton grown in the Sudan. It forbids ginning except under licence, and permits the promulgation of regulations having the force of law to control such matters as cultivation, ginning and marketing.

The most important regulations under the Ordinance were promulgated in 1926 and deal mainly with the control of pests and diseases. Under these regulations all plants of cotton, bamia, till, kirkade and all varieties of hibiscus must be pulled out by the roots and burned on the land by a date to be decided by the Governor each year. The date is usually 31st May. As explained in section 9, this is necessary to prevent outbreaks of blackarm, leafeurl and bollworm. All seed-cotton must go to a licensed ginning factory, the ginned seed may not leave there except under a permit from the Director of Agriculture, and no seed may be sown unless it has been obtained from the Ministry of Agriculture. This provides an opportunity for the treatment of all seed against blackarm and pink bollworm by the Ministry before it is sown.

Local Government Standing Orders :

Control of pests and diseases comes under local government standing orders also. In Kosti District bamia may not be grown in July, August and September. In Ducim District, bamia may not be grown between 1st June and 15th September nor maize between 1st May and 15th August within one mile of a cotton growing pump-scheme. Summer-grown maize is liable to be heavily infested with stemborer, which may transfer itself to the irrigated dura crop if there is an overlap.

Land Tax.

Under the taxation of Land and Date Trees Ordinance 1925, pump-schemes are liable for payment of land tax, the rate per feddan being assessed each year. The tax has to be paid by the licensee and may not be passed on to the tenants.

Business Profits Tax :

Under the Traders' Licence and Taxation of Business Profits Ordinance and Regulations 1929, a pump-scheme is liable for business-profits tax if the total capital employed in it exceeds LS.5000. In this case, too, the tax is payable by the licensee and not by the tenants.

To avoid double taxation, the amount paid in land tax is deducted from the assessed business-profits tax. Frequently a licensee has other business interests. In such cases his business-profits tax is assessed on his total profits and his land-tax payments deducted, but with the proviso that the ratio of deduction for land tax to total business-profits assessment must not exceed the ratio of the profit from his pump-scheme to his total profit. For example, a man makes a profit of LE.1000 out of his pump-scheme and LE.3000 from his other activities. His business-profits tax is assessed at say LE.150 on his total profit of LE.4000, and he is liable for say LE.50 in land tax. His profit from the pump-scheme is one quarter of his total profit, therefore he cannot claim a rebate in respect of land tax greater than one one quarter of LE.150 i.e. LE.37.50m/m.

Public Health.

The law on public health as it affects private pump-schemes on the White Nile is all contained in Sections 24 and 25 of the Blue Nile Province Standing Local Government Orders promulgated under the authority of the Local Government (Rural Areas) Ordinance 1937. They aim mainly at the control of malaria-carrying mosquitoes and to a less extent bilharzia-carrying snails. As these orders are contravened more often than any other law on pump-schemes, it is worth stating what the most important of them are.

(1) Canals shall be constructed so as not to seep. If seepage should occur, all reasonable steps must be taken to prevent its recurrence and any pools of stagnant water standing for three days must be oiled.

(2) Pits, e.g. borrow pits, and depression in which stagnant water may collect, shall be filled in or drained, or may be treated with oil or other larvicide.

(3) The heads of "abu ashmins" shall be oiled.

(4) Canals, water-channels and drains shall be kept free from weeds and other obstructions if they are likely to encourage the breeding of mosquitoes and snails.

(5) Regulators, pipes and culverts shall be constructed and maintained so as to be reasonably watertight.

(6) After 15th September each year, "abu ashmins" and their heads shall be baled, oiled or treated with other larvicides, within three days of the completion of each watering.

(7) At the end of each season heads of "abu ashmins" shall be filled in.

(8) All gardens and the channels leading to them shall be completely dried out for one day in the week.

(9) Tenants are responsible for ensuring that "bomba" and "abu sitta" pipes are watertight, for baling out "abu ashmins" and their heads and for filling these in at the end of the season. Compliance with all the other orders is the responsibility of the licensee unless the Public Health authorities agree to accept it.

24. IN CONCLUSION

"Many forests, moors and commons as they are now enjoyed through the oppression of the Rich, the sloth and idleness of the poor and the misusage of all."

Walter Blith (1652)

Ducin pump-scheme has been operating since 1927. Most of the other pump-schemes on the White Nile have been opened since 1934. How long can they last? The answer depends on the standard of management.

Dueim has had its vicissitudes, but after twenty-two years is still giving reasonable yields, and under good management there seems no reason why it should not continue to do so indefinitely. The chief danger lies, not in loss of soil fertility, but in such a heavy infestation of sedge that the land is no longer worth cultivating. Even since 1934 large areas on Private Schemes have gone out of cultivation for this reason. Unfortunately, licensees and tenants regard sedge as an act of God, and when, through neglect, land becomes foul, they regard it as only natural that it should be abandoned and some fresh land taken in to replace it and be treated in the same way. The co-existence of shifting cultivation the most primitive form of farming, with centrifugal pumps and diesel engines, within the same agricultural system, is a striking illustration of the country's present stage of development. The danger from wind-blown sand is outside the management's control, but is none the less real.

The standard of management on the smaller schemes, though variable, is on the whole fair. On the larger schemes, however, the evil effects of the absentee licensee, combined with the incompetent manager, are obvious. Some schemes were on the point of being abandoned when the recent rise in cotton prices stimulated the licensees to greater efforts. Outside Government service, there is no such thing as a profession of pump-scheme managers. In Dueim district, for instance, there is only one private scheme-manager with whom it is possible to discuss fertilisers intelligently. As the licensee hates to see any money going outside his family and will not pay at rates sufficiently high to attract competent men, the post of manager goes to one of his family, and not necessarily the most intelligent one. Attempts by members of the licensees' families to obtain diplomas of the School of Agriculture and thus qualify themselves, have not so far proved successful. The general view is that any fool can run a pump-scheme.

The Government takes the view that the waters of the Nile are a national asset, the benefits of which should accrue to the country as a whole and not only to riverain residents. The profits from its pump-schemes therefore go into the general exchequer to provide social services, such as

schools and dispensaries, all over the country, so that Fātisa shares with Fasher, and Ducim with Doka. The profits from Private Schemes, however, apart from some light taxation, go into the licensee's pocket for his own comfort and aggrandisement. It might be thought that the White Nile would benefit from the spending of all this money locally, but in fact most of it flows into Omdurman and very little provides local employment. So arise the inevitable questions, is the nation's asset to be consumed in an inefficient way and for the personal gain of a few ?

It would be entirely false, however, to picture a pump-scheme as a place where the poor helpless tenants have their faces ground in the dust under the heel of a rapacious licensee. The tenant is equally feckless. Though he does not work very hard, as will be clear to anyone who drives through a scheme and counts the number of men working at any time, he receives an adequate reward for what he does. He always has his grievances, and indeed would be most unhappy without them, but they are seldom of importance, though sometimes exploited by outsiders from personal or political motives. The best interests of the tenants are served by firm management.

In attempting to understand the tenant and his ways, it is wrong to regard him as merely Mohammed, holder of tenancy No. 397, with a house at Hillat el-Bir, a wife, three children, four cows, a donkey, ten sheep and five goats. The picture should rather be of a family of brothers, uncles and cousins living on "Qoz Atshan", keeping a large mixed herd of animals, and cultivating a few fields of rain-grown dura. One of the family, Mohammed, lives down on the pump-scheme looking after the tenancy, and he is the family's insurance against the failure of the dura crop. He has some of the family herd with him, and the grey cow will probably be going down there soon to rest before calving. Grazing is scarce, and it would be a good idea to send the whole herd down, but Mohammed has sent news that a man has actually been imprisoned for animal trespass and the risk is too great. Mohammed is getting tired of life on the pump-scheme, and it would be nice to let him return home and put his brother Yousif in his place, but Yousif is inexperienced and might do so badly as to be evicted and the tenancy is too valuable to risk that, so Mohammed must stay.

Mohammed is not an individual; he is a member of a community, and that community is not the pump-tenantry. It is one of our tasks of make it so.

جمهورية السودان
وزارة الزراعة

بالتين نمرة ٧

ادارة المشاريع بالنيل الابيض

تأليف

ج . ر . م . موصو

لجنة النشر الزراعية

الخرطوم

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الثمن ٣٠ قرش