Budget for a farmer adopting medic.

Introduction

The budget is the simplest and most effective means of persuading farmers to adopt a new rotation. The comparison of the rotations in previous chapters (Rotations Compared) shows there are many reasons for changing from the cereal-fallow rotation but ultimately they must all be distilled down to one reason - the farmer must make a profit.

This budget is specially designed for small farmers who already have a small flock of sheep.

In this budget we do not attempt a full account of all costs and returns on the farm or even those costs and returns that relate to the sheep enterprise. Instead we show a simple budget of those cost and returns that **change** when medic pasture replaces fallow. It is therefore a **PARTIAL BUDGET.**

* The budget is expressed in cash terms. That is costs and returns actually paid in cash and costs such a hay or straw which can be sold easily and turned into cash.

* Depreciation, the value of nitrogen for the following cereal crop or other benefits are not included.

* The farm family labour is not included as we assume that it is already engaged in shepherding the farm flock of sheep.

The framework for the budget is as follows:-

* To list all the physical and technical changes that take place on the farm as the result of the proposed enterprise.

- To apply values and costs to the changes. Permanent labour is excluded from the partial budget. Capital is not considered until the end.

Physical and technical changes

The changes are as follows.

* Medic pasture is established to replace the weedy fallow. The medic can be established using seed. The pasture is sown in the autumn and is ready to graze perhaps 6 to 8 weeks later. Alternatively the pasture can be sown using pods. The pods are broadcast on the cereal crop. The medic pasture regenerates with the first rain about one year later.

* The medic pasture provides feed for the sheep. A large part of the hay and grain fed to sheep in winter can be saved.

* In spring the pasture produces abundant feed. Lambs will grow to a heavier weight.

Values and costs.

* The medic pasture will cost money to establish.

* The hay and grain saved during winter is cost reduction. The surplus can be sold by the farmer. In future years the farmer will not need to purchase feed.

* The extra weight of the lambs in spring is translated into higher prices.

Other costs are ignored for the purposes of the partial budget. The cost of veterinary medicines for example remain the same whether medic is sown or not. It is important to emphasise that ignoring these cost does not mean they are not important. The only reason is to keep the budget simple - just the costs or returns that change are included.

Existing situation - before medic is established.

In most cases the cereal-fallow rotation with the sheep being grazed on the fallow and the cereal stubble

is the existing situation. The sheep require hay and grain during the autumn and winter as the sparse regeneration of weeds after the cereal crop provides little feed.

* Costs

Existing feeding costs for sheep are included in the budget. These costs include home grown and purchased products such as hay, straw and barley. If they are grown on the farm they can easily be sold and turned into cash. We have therefore included them as a variable cash cost. Veterinary medicines and other fixed costs (such as labour for shepherding) are not included in the budget because these costs do not change between "before medic" and "after medic."

On most farms in the WANA region sheep are fed hay, grain and straw during the winter because the weedy pasture on the fallow (natural regeneration after the cereal crop) produces very little forage. This feed is a substantial cost for the farmer.

* Returns

The returns from the sheep flock consist of the sale of lambs in the spring and early summer. Some sheep are killed for the family. These are not included in the budget as an opportunity return because the budget is all about cash returns. The weedy fallow is cultivated in the spring and the sheep have little to eat until the cereals have been harvested and they can graze the cereal stubble. The sheep are fed on roadsides and the parcour and perhaps some hay. Growth rates for lambs are poor.

After medic - the first year.

* New costs

The new costs will be the establishment of the medic pasture in the first year and then the use of phosphate in subsequent years.

The farmer can use seed. This will require the purchase of seed. The land will need to be cultivated and the seed sown, 100 kg of phosphate will need to be applied. Using seed is a high cost option and the seeding will conflict with the sowing of cereals in the autumn. On the positive side if the season is good the pasture can be grazed in 6 to 8 weeks after sowing.

Alternatively the farmer can use pods. These can be considerably cheaper than seed if he is able to harvest them himself. The lower cost will mean that he will be able to use more pods and establish a better pasture. There is no sowing or cultivating cost as the pods are broadcast over the cereal crop. This task is carried out with family labour during winter and is not included as a cash cost. The returns from the pasture are not received until about a year later.

* Reduced costs.

With a medic pasture the immediate effect is a reduction in feed costs in autumn and winter. Surplus hay and grain usually fed during the first winter can be sold. The medic pasture will provide a greatly increased production of forage compared to the fallow pasture. Cereal straw will be required, perhaps in greater quantities but there will be a net gain in the sale of surplus supplementary feed. Hay and grain are more valuable than cereal straw.

* New returns

In the spring the medic pasture will grow strongly and provide abundant feed for the sheep and lambs. The lambs will reach a greater weight and will be sold for a higher price. Assuming that the same proportion of the lambs are used for the family they will benefit also. This increase in the opportunity return has not been included.

Income and costs combined into a budget for medic pasture.

The following can be printed off and used by farmers and extension agent.

MEDIC PASTURE AND LIVESTOCK BUDGET

Season	
Name of farmer	
Address	
Area of farm	
Area of medic	
Number of sheep	

	Present system of grazing sheep on weedy fallow, hay and grain.	Proposed system based on medic pasture replacing the weedy fallow.	
		Medic sown from seed.	Medic sown from pods.
Income:	Existing returns from sheep on fallow and stubble	Sheep heavier due to good feed in spring.	Sheep heavier due to good feed in spring.
Number of sheep sold			
Weight of sheep			
Price per kilo			
Total return from sheep			
Cost of feed:	Supplementary hay and grain needed.	Pasture production good. Less hay and grain needed.	Pasture production good. Less hay and grain needed.
Hay cost			
Grain cost			
Straw cost			
Other cost			
Total feed cost			
Cost of pasture:	Regenerates naturally. No fertiliser. No cost.	Seed, seedbed preparation and sowing. Fertiliser.	Pods a year earlier Fertiliser is year.
Cost of seed or pods	Zero		
Cost of seed and sowing.	Zero		
Cost of phosphate fertiliser.	Zero		
Total cost of pasture			
TOTAL COST - (FEED COST + PASTURE COST)			
TOTAL RETURN (Income from sale of sheep			
MARGIN OF RETURNS OVER COSTS			

Gross margins for second year of medic pasture

The medic pasture will regenerate in the following year without reseeding. I recommend that farmers keep the medic for at least two years before sowing cereals even if the classic medic-cereal rotation is adopted in the long term. This will give the medic a chance to build much stronger seed reserves in the soil. With the Zaghouan 4 rotation the medic pasture remains for two and half seasons.

The second year budget should be considered at the same time as the first as it will provide the farmer with greatly increased gross margins.

	Present system of grazing sheep on weedy fallow, hay and grain.	Proposed system based on medic pasture replacing the weedy fallow.	Proposed system based on medic pasture replacing the weedy fallow.
		Medic sown from seed.	Medic sown from pods.
Income	Same as above	Second year pasture more productive. Income from lambs sold greater.	Second year pasture more productive. Income from lambs sold greater.
Feeding costs	Same as above	Medic pasture will be more productive in early autumn due to high seedling density. Feed costs lower	Medic pasture will be more productive in early autumn due to high seedling density. Feed costs lower
Pasture costs	Zero	Phosphate only	Phosphate only
Margin of returns over costs	Same as above	Greater as pasture costs reduced.	Greater as pasture costs reduced.

Capital flow.

Assuming that the returns from medic pasture are good (particularly when taken over two years) the farmer will consider changing his farming system. In addition to the budgets above he will need to consider the capital flow.

	Proposed medic pasture based on SOWING WITH SEED		Proposed medic pasture based on BROADCASTING PODS	
	Cash OUT	Cash IN	Cash OUT	Cash IN
Spring of year earlier			Cost of harvesting pods	
Autumn of year earlier			Cost of broadcasting pods	
First year medic				
Autumn of establishment year.	Cost of seed, sowing and fertiliser		Cost of fertiliser	
Winter		Saving in feed costs. Surplus can be sold for cash.		Saving in feed costs. Surplus can be sold for cash.
Spring/early summer		Addition returns from sheep		Addition returns from sheep
Second year medic				
Autumn	Cost of fertiliser.		Cost of fertiliser.	

Winter		Saving in feed costs. Surplus can be sold for cash.		Saving in feed costs. Surplus can be sold for cash.
Spring/early summer		Addition returns from sheep		Addition returns from sheep

Where do all the figures come from?

Over time as extension agents and farmers gain experience with medic pasture and it will be easy to estimate the amount of hay and grain saved during winter and the increased income from sheep.

When that knowledge has been accumulated there is no need for this web site or at least this chapter!

Of course providing advice is difficult as there are so many variable but I will try to identify them to improve the quality of the estimates made at a local level.

* Income from sheep

The farmer knows the existing number of sheep sold and the average price.

Medic pasture will provide considerably more feed in the spring. The young sheep will grow more on green medic and dry pods. They can be sold at a heavier weight and higher price.
First we need to exclude the seasonal effect. Obviously growth rates will be poor in a drought but in an average season growth rates will depend on the quality of the medic pasture and the stocking rate.

A high quality pasture is one with a high density of medic seedlings. For a first year pasture more than 500 seedlings per sq. m. is a good establishment. Densities below this will recover and produce well in the spring provided grazing management is good.

With a good medic pasture and reasonable stocking rate the farmer can expect to gain an additional 5 to 10 kg of live weight per lamb at three months of age compared to sheep and lambs grazed on a weedy fallow and roadside grazing.

* Feed for sheep in autumn and winter.

At present the production of feed from the weedy fallow is low. Usually the weedy fallow will support about 0.5 sheep per ha. As most farmers carry more sheep per ha. they need to feed hay and grain to fill the deficit.

Medic sown from seed will be slow to come into production. The land is cultivated, harrowed and sown in the autumn after the first rains. The seed germinates and grows. The later sowing of seed compared to natural regeneration means the days are shorter and colder.

When the pasture is 7-8 cm high grazing begins. Farmers must expect to feed hay and grain during the period up to the point when the pasture can be grazed.

It is wise to allow 6 weeks of feeding. Seedling density is vital for early production. Seedling density is dependent on seeding rate and the quality of the seedbed. High seeding rates will produce earlier pasture growth but can be costly.

When the medic has reached 8 cm grazing can begin but the medic will not support the sheep flock completely. Straw is fed a night. Straw costs less than hay and grain. A reduction in feed costs by 30 to 50% can be expected.

Medic germinating from pods broadcast over a cereal crop will have better early production. The density of the pasture will be greater. The medic pasture will germinate earlier than one established from seed as there is no need for cultivation and sowing. Pasture density should be better as pods are cheaper than seed and sowing rates can be higher. A four week delay in grazing would be reasonable. A reduction in feed costs of 50% or more can be expected.

Second year feed costs for both types of medic establishment should be low. Provide there has been good summer management there will be a high carry over of pods and an excellent density of

seedling in the autumn. Again some hay and grain will be needed until the pasture reaches 8 cm and some straw after that. A reduction of 50% to 75% in feed costs can be expected. The 75% reduction would apply where lambing has been delayed until after the medic pasture is 8 cm high.

* Cost of establishing the medic pasture.

Estimating the establishment cost using the seed method is easy. The price of the seed and seeding rate gives the seed cost. Contractor rates are available for cultivation and harrowing. The farmer can broadcast the seed and fertiliser by hand.

For the pod method there are many option.

Government centres can allow farmers to use the pod harvester and harvest an area of existing medic pasture for a fee.

Farmers can buy pods from another small farmer.

Farmers can expand their area of medic by harvesting their own pods with a pod harvester hired from a cooperative.

Broadcasting the pods is carried out with permanent family labour.

Break-even budget

The objective of a break even budget is to assess risk.

The principle is to rework the figures in the partial budget shown above to provide a ZERO return.

A zero return means that the farmer has recovered his expenditure and not lost any money. A break-even budget then works back from the zero return to calculate the increased income or reduced cost needed to break even.

In the case of the proposed medic pasture this is not easy as there are two benefits - increased meat production and reduced feed hay and grain consumption. I suggest that the benefits are applied equally.

An example:

Let us say that the Partial Budget estimates an increase in income from 7 kg of meat per sheep for ten sheep.

It also estimates a reduction in feed cost by 40%

When pasture establishment costs are taken into account the gross return is X Dinars

For a Break-Even Budget the Gross Return is fixed at zero.

With a zero Gross Return the income and cost saving are recalculated. For example they may be 3.5 kg per sheep and 20% feed saving. These are very modest levels and should be easily exceeded by a farmer unless there is a severe drought. If the farmer merely reaches these levels he Breaks Even. That is no money is lost. Any production or cost saving above this is a Gross Return.

For the second year of medic pasture the only cost is phosphate fertiliser. The Break-Even production levels and cost reductions are very low indeed.

Break-even budgets are particularly useful when large amounts of capital are being invested. It is important to calculate the point at which serious losses will occur.

MORE ADVANCED SECOND YEAR BUDGET FOR LIVESTOCK

LAMBING PERCENTAGE AND REDUCED DEATH RATE

The First Year budget looks at the income and costs for sheep grazed on medic for the first six

month to a year.

It is simple and has considerable impact.

The increase in feed quantity and quality with medic means that lambs are born with a higher birth weight, the ewes have more milk and the lambs grow faster once they are weaned. The lambs reach a considerably heavier weight in the spring and early summer. More male lambs are sold. That is the end of the first year budget.

* Existing growth pattern with the cereal-fallow rotation.

The lambs in the cereal-fallow rotation have an inadequate level of nutrition during winter and spring. The weedy fallow and roadsides provide little feed and the quality is poor. Supplementary hay and grain is expensive.

The grazing provided by the cereal stubble in summer provides some good quality feed at first. Harvesting of cereals is often inefficient and some grain is left on the ground where it is eaten by the sheep. Chaff is also available for the sheep. It has a better feed value than cereal straw.

As the best of the stubble is eaten out the growth of all sheep stops and they begin to lose weight.

For young sheep this is particularly important as they have not had enough feed to accumulate reasonable fat reserves. Loss of body weight can cause permanent stunting or even death. Lack of feed is not the only cause of death. Animal diseases are also a problem but as with many agricultural improvements good feeding not only makes animals less vulnerable but provides a greater economic incentive to farmers to take preventive measures.

Controlling animal diseases may seem of little value to the farmer if the animals are going to die of starvation in any case.

Adult female sheep are mated for the following season during the early summer. The fertility of the female sheep is dependent on the body weight. Fertility is particularly low if the body weight is falling. Sheep grazed on cereal stubble alone will gradually lose weight during summer.

* Growth pattern with medic pasture.

Lambs are borne during the winter months as above. Birth weights are higher and milk production better.

In spring there is an abundant growth of medic pasture. Lambs grow rapidly on high protein green medic.

When the medic pasture dries off in early summer the sheep eat the dry medic pods. Growth of lambs continues. It should be possible to sell all or most of the surplus male sheep at this point. This improvement is allowed for in the first year budget.

When the cereal stubble is available after harvest the sheep are transferred to the stubble and continue to grow as above.

When the best of the stubble has been eaten out the young female sheep should be separated off from the old sheep and transferred back to some dry medic pasture that has been kept in reserve. Unfortunately on small farms that is not a practicable management option as only one shepherd is available. All the sheep are therefore grazed together and lose weight.

The weight of the young sheep at the beginning of summer is much greater with medic pasture than the cereal-fallow rotation. The young sheep are able to withstand some weight loss from fat reserves. Their survival rate is higher.

Adult female sheep have a higher body weight when they are mated. Their fertility will be higher in the following season.

PUTTING SOME FIGURES TOGETHER

* Cereal-fallow rotation

A simple example for a small farmer:

20 female sheep. + 1 male = 21 in total.

Lambing percentage 70% (this is higher than the national average for Algeria over the last decade which was 62%)

Lambs born = 14

Deaths of lambs during summer = 2

Deaths of adult sheep = 2

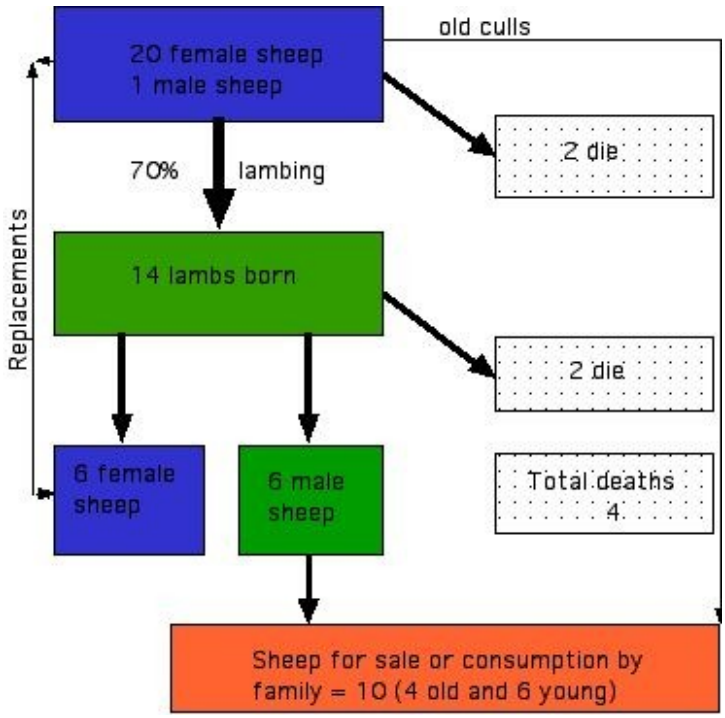
Surplus of births over deaths = 10

Females are used for replacements to the breeding flock.

Available for consumption by the farm family or for sale: = **4 old female sheep + 6 young male sheep**.

Total = 10

The chart below explains the flock changes over the season.



* Cereal-medic rotation.

An example of the benefits of medic pasture in the second season and further season where the pasture regenerates. This is a better indication than the first season where establishment can be variable.

In the first season the benefit was the higher body weights for lambs in the spring. This will occur even if the establishment was not optimum.

In the second season there are higher body weights and greater numbers. The increases (shown below) of 10% in the number of lambs born and 10% decrease in the number that die are very modest. Greater increases have been achieved. The figures below were comfortably exceeded by Libyan farmers in the Jebel al Akhdar region of eastern Libya when medic pastures were introduced there in the 1970's.

20 female sheep + 1 male = 21 in total.

Lambing percentage 80%

Lambs born = 16 (say 8 males and 8 females)

Deaths of lambs during summer = 0

Deaths of adult sheep = 1

Surplus of births over deaths = 15

5 females are used as replacements for the breeding flock.

Available for consumption by the farm family or for sale = **4 old female sheep + 8 young male sheep** (sold in spring) **+ 3 young female sheep.**

Total = 15 = 50% increase over cereal-fallow rotation.

Let us assume that half (5 sheep) were consumed and half (5 sheep) were sold under the cereal-fallow rotation and that the family continues this level of consumption (5 sheep). If this is the case the number of sheep for sale with the medic rotation is **10 or double** those available under the cereal-fallow rotation.

The above example is conservative for the medic rotation. In fact lambing percentages of more than 80% have been achieved. The greater weight and price of the sheep was the benefit described in the first budget. It applies to these lambs also.

In summary:

* Cereal-fallow produces surplus 10 sheep from a flock of 20.

* First year medic produces 10 surplus sheep that are heavier and worth more. The flock is still 20 ewes.

* Second year medic produces 15 surplus sheep that are heavier and worth more. The flock is still 20 ewes.

INCREASING THE STOCKING RATE

When medic pasture is introduced as a replacement to the fallow it is important to plan the area of medic so it is in balance with the sheep flock or cattle numbers.

In the following years it is possible to increase the area of medic pasture and the flock size. The increased production comes from:

higher body weights) + (increased numbers for sale from the same flock number) + (a larger flock).

For example in the Jebel al Akhdar region of Libya farmers easily doubled the size of their flocks as well as increasing the productivity. They were using the traditional Australian cereal-medic rotation.

If the flock size is doubled from 21 in the above example to 42 sheep the output is now 30 sheep for sale or consumption by the farm family. This is **three times** the output under the cereal-fallow rotation. The increase in the flock size can be achieved by purchasing more sheep or more likely by retaining the surplus young female sheep and keeping old female sheep for a longer period.

If small farmers adopt a Zaghouan 4 rotation they will increase their flock size even further. With the Zaghouan 4 rotation there is 2.5 years of medic, 0.5 years of fallow and 1 year of cereal. Cereal yields will be higher, perhaps as much as 100% greater so straw production will be similar to the cereal-fallow rotation. There will be a greater area of medic pasture and flock sizes can be increase by more than double. In the above example perhaps 53 sheep with an output of 38 or nearly four time the number produced with the cereal-fallow rotation.

MORE COMPREHENSIVE COSTING FOR FUTURE YEARS

The partial budget described at the top of this section is perfect for the introduction of an area of medic pasture onto the farm to feed the existing sheep flock. Over the years as the whole rotation changes it is necessary to look at the farm as a whole to see where costs and returns change.

* First year medic.

+ Flock size the same.

+ Reduced cost of winter feed.

+ Fixed costs the same.

+ Increased returns from heavier lambs.

* Second year medic.

+Flock size the same.

+ Reduced cost of winter feed.

+ Fixed costs the same.

+ Increased returns from heavier lambs.

+ More lambs and lower death rate.

* Third year medic on greater area.

+ Flock size is now increasing. On small farms the increase can be handled by a single shepherd. It seems that a limit of 150 to 200 sheep can be handled by a single shepherd. Small farmers will not reach this level.

+ Larger flock will need larger bergerie for keeping sheep overnight. This will need to be costed in. The cereal phase of the rotation will change as the medic area takes over all the fallow.

If the classic Australian style of rotation is used with one year cereal and one year medic the farmer must change to shallow cultivation. Special equipment is needed. It can be purchased by the farmer or the contractor.

If a Zaghouan 4 rotation is adopted the traditional deep ploughing can still be used. It will be more costly on an annual per hectare basis but as the equipment exist no new investment is required. As only 25% of the arable land is sown to cereals the cost will in any case be less.

A farm for example that converts from cereal-fallow to a Zaghouan 4 rotation could achieve the following.

* Increase in sheep output for sale from 10 to 38 and an increase in the weight of each sheep.

* No increase in fixed costs as a breeding flock of 53 sheep is well within the capacity of a single shepherd.

* Feed costs for each sheep similar. Less hay and grain. More cereal straw.

* Cereal output at nearly 100% yield increase giving the same total amount of grain from half the area.

* Cereal costs on 25% area sown (instead of 50%) considerably less.

Total profit considerable greater. Investment small.

NITROGEN FOR THE CEREAL CROP

My recommendation is that the benefit from the additional nitrogen is not included in the budget for medic. If the medic is grown for two years at the initial establishment stage the budget should cover those two years. The nitrogen benefits are too distant to be included as a return to the medic pasture.

Besides there are complications which I will explain below.

How much nitrogen?

The amount of nitrogen supplied by the medic pasture varies according to the quality of the pasture and the means of utilisation.

A good medic pasture - that is perhaps 95% or more legume - will provide 70 kg or more of N per ha. If this is returned to the soil through grazing rather than being removed as hay it will be sufficient for the next cereal crop. While 70 kg can be priced as the equivalent to 150 kg of urea it is much easier to use.

I show on the web site how difficult it is to apply nitrogen to cereal crops at the right time and in the right amounts. A failure to achieve the correct balance can result in a yield reduction. The problems of nitrogen application are particularly acute in the parts of the cereal zone with lower rainfall.

The nitrogen supplied by the medic pasture comes from the breakdown of organic matter. It is a slow release fertiliser that is suited to the requirements of the cereal crop and does not result in yield reductions.

The use of medic can provide additional benefits that are not yet fully understood. In an interesting series of experiments conducted near Erbil in Iraq there was a 10 qx. per ha, yield increase for wheat sown after medic pasture at all levels of N application up to 300 kg per ha of urea.

That the yield of wheat after medic was nearly 10 qx. higher than the yield of wheat after wheat was not surprising but as more and more nitrogen was applied to the wheat crop the 10 qx gap remained between wheat after wheat and wheat after medic pasture.

The yield of wheat after wheat rose from 13 qx. per ha with zero application of urea to 22 qx. when 300 kg of urea was applied but the yield of wheat after medic pasture showed the same relative increase.

Wheat after medic started at 22 qx. with zero additional urea and climbed to 32 qx. per ha when 300 kg of urea was applied.

Turning the additional nitrogen into yield

The experiments conducted at Erbil in northern Iraq clearly show the advantage of medic pasture in a cereal rotation.

Similar increases in yield have been achieved elsewhere in the WANA region. Libya, Jordan and Iraq have obtained the clearest yield responses. They imported scarifiers for shallow cultivation and Australian farmers to demonstrate their use. The increase in fertility was translated into increased yields.

Elsewhere the transformation of soil fertility into increased yield has been complicated by weeds. In Algeria at El Kroub and El Khemis scarifiers were used and excellent cereal yields were obtained after medic.

They were the exception however. More generally deep ploughs were used in Algeria - set at a shallow depth for cereals after medic - and the results were poor to disastrous. Weeds took the fertility not the cereal crop.

I n Tunisia good yield were obtained after medic but as the farms were not equipped with scarifiers this was achieved using deep ploughing. The medic pasture generally failed to regenerate as the pods were too deeply buried by the deep ploughs.

Similarly ambiguous result were obtained in Morocco.

A budget for the medic - cereal rotation.

Clearly this is most important in the longer term. The additional nitrogen provided by the medic pasture is a substantial cost saving but only part of the total budget which must include the change to effective shallow cultivation with scarifiers.

A budget for the Zaghouan 4 rotation.

This is a more simple exercise. At least in the short term the same techniques of cultivation for the fallow and sowing the cereal crop can be used.

It is therefore possible to say that the medic pasture produces a 80 to 90% increase in yield of cereals. This increased return is not all profit as it is necessary to establish the medic pasture again.

Pods must be harvested and broadcast over the cereal crop.