AMBASSADOR COLLEGE UNITED KINGDOM

Your Living Environment

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ENVIRONMENTAL RESEARCH AT AMBASSADOR COLLEGE

"If you live by my rules and follow my orders obediently, I will give you rain in due season, the land shall bear its crops, the trees shall bear their fruit; your threshing shall last till the time for vintage and your vintage shall last till the time for sowing; ... you shall have to clear out the old to make room for new supplies" (*Lev. 26:3-5, 10 Moffat*).

This is hardly what is happening to mankind today, despite all the recent *"advantages"* of modern agriculture. Every one of us owes our very existence to the Almighty Creator God who made this promise. Then *why* is He not blessing us as He *promised?* Could it be that we are not obeying the *"rules"?* Could it also be that with the passing of generations we have even lost knowledge of many of the *"rules"?*

One has only to read on in *Lev. 26, Deut. 28* and many other places in God's Word to see law-breaking is the cause of our punishments and that worse is to come! Then it is vital that we *re-capture true values* in ALL areas of life, including AGRICULTURE and ENVIRONMENTAL MANAGEMENT. That is precisely the role of this Department (apart from growing whatever food we can for the College).

Regaining knowledge however, is of no value unless we can do something with it. That's why we have been publishing material like this for some three years — to make our findings available to those who are interested.

That is also why we operate a letter-answering service to people in more than 30 countries, from Norway to New Zealand and from Tonga to Togoland.

Our research is based on the Bible and extends to any part of the world where information on Agriculture is published in the English language.

Occasionally we even have people translating for us or interpreting in personal interviews.

Over and above all of this, there are still certain things we can do in practice right here on the College farm. With this in mind we have set up an *Experimental Section* where we can carry out various field trials. In this combined issue we want to give you some idea of the programme we have been carrying out. At the same time we will also give you some of the reasons why we feel it was worthwhile to carry out these trials.

FERTILISING VEGETABLES

High fertility soil will grow healthier and more nutritious vegetables. Home gardeners want this, but what is the best way of achieving it?

For several years we have been investigating methods of improving soil in our *Vegetable Section.* There is still much room for improvement, but considerable progress has been made and now we have a soil vastly superior to that with which we started.

While still pushing ahead with development of the *Vegetable Section* we have now started a trial

in our new *Experimental Section* to compare various organic manures.

The comparisons are between:

1.	WELL ROTTED COW-DUNG
2.	FRESH COW-DUNG
3.	COMPOST
4.	STRAW
5.	HYDIG (dried sewage sludge)
6.	CONTROL PLOT
7.	GREEN MANURE

Immediately after germination, differences between treatments became apparent. The *composted* area quickly showed up with the most prolific growth. The *old-dung* plot was the next best early performer, followed by the *Hydig, new-dung, control* and *straw.* (We have no results from Plot No. 7, because it was raising its own green-manure crop in the first year.)

There was a marked difference between the *old-rotted dung* and the area manured with *fresh dung.* This difference remained for the whole season, although the final yield was not affected. Obviously as the season progresses *"fresh"* dung rots down and becomes indistinguishable from *"old"* dung. Our results indicate that although fresh dung retarded early growth this may be unimportant to eventual yield.

Compost gave better yields than any other plot, but the trial needs to go on for several years so that cumulative effects can be fully observed and assessed. At present, for example, the area under straw is at a disadvantage because there has not yet been a chance for earthworm activity to reach its full development underneath the straw.

As mentioned earlier, we planted a selection of vegetables across these *seven* soil fertility trial plots. Not all species of vegetables responded in the same way. These results amply demonstrated the wisdom of planting a *selection,* but at the same time this variation in response complicated the task of assessing results.

It is much too early to draw final or even firm conclusions at this stage. And it must be remembered that the soil fertility system of highest value is the one that proves its value in the *long-term!* Future years should prove interesting.

DEPTH OF SOWING

John Hepburn, in his book *Crop Production, Poisoned Food and Public Health,* wrote a chapter on depth of sowing cereal grains. He points out that it affects the plant in *three* ways, stating that deep-sown crops are more prone to:

1. Lodging
2. Drought
3. Wireworm attack

He produces some very convincing photographs in support of his theory that the conditions surrounding root development induce these problems. These show root development at various stages of plant growth.

OUR TRIAL

It was decided that his experiments were of sufficient interest for us to set up a small trial to investigate the effects of sowing depths on wheat as a check on Hepburn's findings.

On April 28th, 1971 *four* plots of Janus spring wheat were sown. The four depths that we selected were:

1. Surface sown (not part of Hepburn's trial)
2. ½"
3. 1½"
4. 4"

Emergence of the seedlings occurred within the following times:

1. Surface sown — indefinite
2. ½" — 8 days
3. 1½" — 10 days
4. 4" — 12 days

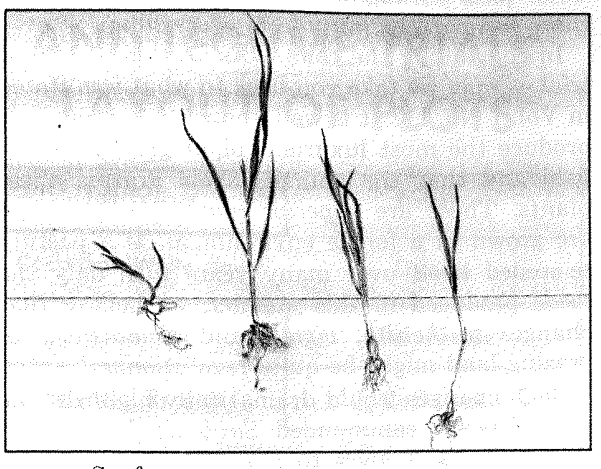
Although the trial was protected from birds, only a few of the *surface-sown* seeds germinated. Many of the *4" plants* failed to emerge because of stones causing the emerging shoots to turn over. This reduced the eventual germination on this plot by approximately 30%.

Photographs were taken at 30, 42, 57 and 89 days. These show the pattern of root development much the same as Hepburn describes it, but in more detail.

Delayed development of primary roots can be clearly seen in plants in the *4" plot.* These roots never did develop to the extent of the shallower plants so the latter *should* have more resistance to lodging.

Surface-sown plants were also slow in developing their roots and never did develop really strong roots.

ROOT DEVELOPMENT AT 30 DAYS



Surface sown ½" 1½" 4"

Between those planted at ½" and 1½" there is little to choose. The plants in the *shallower* plots had a stronger stem in the first 8 weeks of growth than did the 4" plot, but under the conditions of the trial this was unimportant. (Though it could be *most* significant in field conditions.)

ROOT & STEM DEVELOPMENT AT 42 DAYS

Surface sown ½" 1½" 4"

Follow-up trials may be done in a *greenhouse* to simulate drought conditions. This way we could test the theory that *shallow* sowing gives better drought resistance.

Pest resistance will be more difficult to test, but it could be done in an area where wireworm was a problem, or by introducing wireworm to special boxes.

TENTATIVE CONCLUSIONS

From the evidence of root development that we have got so far, it appears far preferable to plant between ½" and 1½". These *shallow-sown* plants were in no way inferior to either the *surface-sown* or the *deep-sown* (4") plants and their vigour was obviously superior. Root development was not only faster, but always remained more substantial.

In addition, less plants will emerge from greater depth, especially in stony soils. This would imply a need for a heavier seeding rate under such conditions, if *deep* seeding is desired.

The primary roots are going to develop just below the surface, no matter what depth of sowing is chosen. It would therefore appear that the only likely advantage for *deep* sowing would be to germinate seeds when the top layers of soil are completely dry. In all other cases sowing at ½" to 1½" should give the best results. Despite any early advantages during the growing season it is recorded by others that yields are not significantly affected.

(We would appreciate any experiences that readers may have had with sowing cereals at various depths which show any conclusive advantages of either *deep* or *shallow* sowing.)

EFFECT OF RUMINANT DIGESTION ON SEEDS

Your Living Environment, Vol. I No. 11 carried an article on the effect of animal dung on plant growth and development. Vol. II Nos. 1 & 2 also referred to the role of ruminant digestion and its effects on seeds.

As a result of the above research we set out to look for any observable *effects* of ruminant digestion on seed germination and subsequent growth. We therefore thought a field trial would demonstrate some of the concepts set out in these earlier issues of the *Research News.*

Early in April, 1972 a small trial was set up using *Italian ryegrass* and *White Clover* seed. Two cows were isolated from the rest of the herd and put onto a controlled seed-free diet for several days. At the end of this time we added a certain amount of ryegrass and clover seed to their rations.

In due course dung from the animals was collected. It contained some of the seeds previously fed to the cows. Together with some of the manure they were then sown into a weed-free area in early May. Two other plots were established alongside — both with the same basic seed mixture as that in the cow manure (*Italian ryegrass* and *White Clover*). One plot was treated

with an application of fresh cow manure. The other had no contact with manure at all. Thus we had three treatments:

COW MANURE SEED TRIAL PLOTS

1. Cow manure containing seed mixture.
2. Seed sown with fresh manure.
3. Seed sown without any manure. (Control)

The treatments were left to germinate while we eagerly awaited the results. All three germinated at approximately the same time, but the area which had been treated with *fresh manure,* (Plot No. 2) had caked hard and so needed watering and loosening to allow the sample seedlings to emerge.

During the subsequent weeks, a marked difference developed between the three. The two plots sown *with manure,* (Nos. 1 & 2) were much lusher and farther advanced. Nothing surprising in this of course. However, towards the end of the growing season, plants from the seeds that had passed through the ruminant digestive tract produced a much higher yield of seed heads than either of the other two plots (Nos. 2 & 3)!

FUTURE OF THE TRIAL

The growth pattern of plots 2 and 3 was so different to No. 1 that it has held us back a year. Why? Because plots Nos. 2 and 3 set so *little* seed!

The reader will appreciate that it was, (and still is) our intention to sow the second generation seed into the same environment as the first, to observe any noticeable compounding effects of these environments.

You can see how the trial can become more interesting as time goes on. Ultimately we should be able to demonstrate some visual genetic changes by the simple process of cross-planting the three plots.

There is much evidence to show that environment can alter genetic characteristics. We know this already. The long-term aim of this experiment is to demonstrate these effects that ruminant digestive tracts may have on seeds.

About this time you might be asking yourself *why* we would expect any *effects* on seeds passing through the system of a sheep or a cow.

We have asked ourselves — if the digestive tract doesn't have any effect on these seeds, why did God design the animals so that a percentage of seeds pass through them? (In God's designing there seems to be purpose in everything).

In concluding the comments on this particular trial — may we take you back to what was stated in Vol. I No. 11? It is well known that *dung-pats* produce the most luxuriant plant growth in any field and that the animals avoid grazing these plants. These are *superior plants* because they are grown in a fertile environment. If a pasture re-seeded itself over many years with only the seeds produced in this manner, we believe that changes in *health, vigour* and *productivity* of grazing land might be quite revolutionary!

Such changes would dramatically highlight the role of God's commanded *Sabbatical Year* and the emphasis it gives to *livestock-based* agriculture.

It will be sometime before we get accurate information on the final genetic effects of ruminant digestion on seeds, but we thought you would be interested in our observations so far.

PASTURE GRASS TRIALS

In August, 1971 we initiated a trial to compare the suitability of growing various pasture legumes, (clovers mainly) and grasses on our land here at Bricket Wood. (You may know already that the College is situated on a somewhat naturally unproductive area of Hertfordshire gravel — a fact that is forcefully demonstrated by the existence of TWO commercial gravel pits adjacent to the boundary of our property.)

A total of 46 plots were laid out, each being roughly 10′ x 6′. Into these was sown the following pasture grasses and legumes, separately and in combinations:

GRASSES
- Cocksfoot (Dactylis glomerata)
- Perennial Ryegrass (Lolium perenne)
- Phalaris tuberosa (Imported Aust. seed)
- Tall fescue (Festuca arundinacea)
- Timothy (Phleum pratense)

LEGUMES
- Alsike clover (Trifolium hybridum)
- Subterranean clover (Imported Aust. Mt. Barker variety)
- White clover (Trifolium repens)

The plots were arranged at random and the species duplicated, to ensure that the results obtained would be consistent.

PASTURE GRASS AND LEGUME TRIALS: LAYOUT OF PLOTS

Tall Fescue	Timothy
Cocksfoot/White clover	Lucerne
Cocksfoot	Tall Fescue
Perennial Ryegrass	Cocksfoot
Cocksfoot/Sub. clover	Phalaris
Timothy	Cocksfoot/White clover
Sub. clover	Cocksfoot/Lucerne
Alsike clover	Sub. clover
Perennial Ryegrass	Phalaris
To be resown	Lucerne
Tall Fescue/Alsike clover	Alsike clover
Timothy/Sub. clover	Tall Fescue/Lucerne
To be resown	Timothy/Alsike clover
To be resown	Tall Fescue/White clover
Cocksfoot/Lucerne	Cocksfoot/Alsike clover
Tall Fescue/White clover	Tall Fescue/Sub. clover
Timothy/Lucerne	Tall Fescue/Alsike clover
Timothy/Sub. clover	Timothy/White clover
Cocksfoot/Alsike clover	Timothy/Alsike clover
Tall Fescue/Lucerne	Cocksfoot/Sub. clover
Timothy/White clover	Tall Fescue/Sub. clover
To be resown	Timothy/Lucerne
To be resown	To be resown

August sowing proved very suitable for all varieties except lucerne, but it may have been affected by sowing techniques. It was decided to replant the lucerne at a later date as the poor germination would not have given worth-while results.

By mid-summer this year, the remaining plots were well established and it was decided to go ahead with some provisional measurements.

PURPOSE AND METHODS

As stated earlier, we wanted to try a number of new pasture species which might be more suitable than those on which we have been relying. However, planting down whole fields to new varieties and doing a full-scale grazing trial is far too extensive for our *Research Programme* at this stage.

On the other hand, planting down small nursery plots would not show how the new types stand up to grazing. We therefore adopted a compromise solution — 10′ x 6′ plots. Although too small to be grazed individually, we were able to graze them all in one block and observe the results.

Before turning cows in to graze, cuts were taken by hand from each plot. These cuts were then dried and weighed to determine total dry weight production from each variety, species and combination. When used in conjunction with the known digestibility for each species, this gives us a good estimate of productivity of each species and variety on *our* land and in *our* environment.

The remainder of the plots could be cut after this, but we prefer to graze them. There are two reasons for this. *First,* the ultimate purpose of our pasture is *grazing,* NOT *cutting* and there is some evidence to suggest that certain species react very differently to grazing than to cutting (see e.g. *Grass Productivity* by Voisin, p.2).

Opening the plots to grazing enables us to evaluate the productivity of each species and variety, under a grazing situation and not simply in the artificial environment of mown plots.

The *second* reason is to get some gauge of palatability. Unlike mowers, *animals* show persistent preferences for certain species and many years of careful plant breeding have often been lost when the end result of *mown* trials has been submitted to the ultimate test. GRAZING ANIMALS are the ultimate test! Sooner or later the results of *every* pasture trial must be submitted for their approval.

By using grazing techniques in the first instance, we not only avoid this problem, but can

also make some estimate of the animals' *preference* for different varieties. (This is vitally important, because God has made cows, as a general rule, instinctively better judges of their own nutritional needs than men are.)

RESULTS

Just by looking at the overall growth, *Cocksfoot* and *Tall Fescue* were by far the most advanced of all the grasses sown. Of the legumes, Australian *Subterranean clover* looked very promising. Accurate dry matter weighings verified our observations, although there was very little to choose between the Subterranean clover and White clover stands. Of all the mixtures, *Sub. clover/Tall fescue* came out well ahead.

Subterranean clover has given very good results in the first year, which makes us think that it may have a permanent place in this country. It will be interesting to see how well it germinates again next year. The biggest problem with this plant here, may be the difficulty of re-seeding itself. (Even if succeeding germinations are poor, there may still be a place for this legume on short rotation leys, if it can regularly produce very good yields.)

Our trial will be continued for many years to test the persistence of all these species and provide a comparison with the other pastures on the College farm. It is envisioned that other varieties will be added to the area as they become available.

From this trial we can constantly evaluate the potential of new species under our conditions, *before* introducing them into our pastures.

WHEAT BREEDING TRIAL

In a previous issue of *Your Living Environment* (Vol. III, No. 7), we asked the question — *Will a very fertile soil produce better seeds than a low fertility soil? If so, does the effect last over several generations?"*

The approach of our Department, (contrary to geneticists and plant breeders) has for some time been that the breeding of plants is *very much* affected by the environment in which they are grown. It is well known that *hardness* in wheat is primarily dependent on the genetic potential of the parent seed. But does this mean that the environment has *no* influence on genetic characteristics?

The underlying principle involved behind this question is a very fundamental one, and differing views have been the subject of many heated debates among scientists.

In 1971, we set out to try to demonstrate that environment *does* influence genetic characteristics, because much evidence exists to prove this.

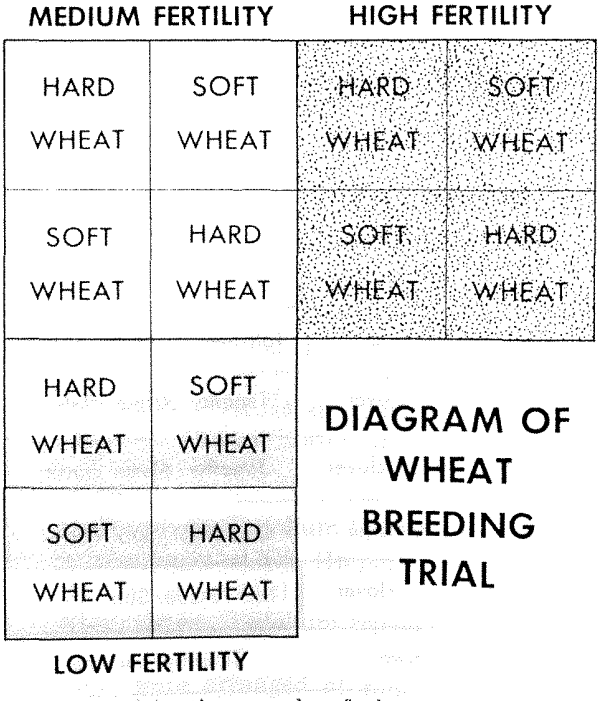
We chose the characteristic of *hardness"* in wheat as our yardstick, comparing a *hard* (i.e. high protein) wheat with a *soft* (i.e. low protein) wheat. Our aim was to discover whether *soft* wheat, bred for successive generations on *fertile* ground, developed a greater genetic potential for *hardness* than the same variety grown on *low* fertility soil. And similarly, whether the *hard* wheat grown on infertile soil developed a genetic potential for softness.

PROGRESS IN 1971

We laid out the trial in an area which had a fertile soil adjacent to a low fertility soil and arranged three areas:

1. A high fertility section
2. A low fertility section
3. What we termed a medium fertility section, where we used inorganic fertilizers.

In addition, the top two inches of soil were removed from both the *low* and *medium* fertility sections and spread on the *high* fertility plot. This topsoil included most of the organic matter.



After cultivation, each of the above sections were divided into four sub-plots, into which *two*

varieties were sown (one soft and one hard) at the same time duplicating each variety.

In spite of several initial obstacles due to late planning, a reasonable crop resulted. But the most disastrous event was the bird invasion which took nearly the whole crop just as it ripened!!

However we managed to save enough seed to get a visual comparison. This showed the effect of treatments to be exactly as anticipated.

PROGRESS IN 1972

The procedure was repeated this year, using new varieties, since we had retrieved too little seed for sowing from the previous year's crop. Unfortunately we were not able to get two spring varieties, and so had to employ a *spring hard wheat* and a *winter soft wheat,* sowing both of them in early April. Yet despite the late start, we managed to obtain sufficient seed to confirm the previous year's observations.

The *medium* fertility plot, however, did give us a brain teaser! There didn't appear to be much difference between the seed from this plot and that from the *high* fertility plot.

It will be interesting to see any developments in the future between these two.

The plan now is to continue with this experiment, keeping the seed each year. By sowing the same seed back in the same area each year, any adaptation to the various environments should gradually take place.

The final test will be to cross-plant the seeds over the various fertility levels to see the extent to which they have departed genetically. At the same time, the quality of the resultant seed will give us an idea of just how much the environment — given time — can influence the genetic characteristic of hardness. Such conclusions would be revolutionary to plant genetics!

WHY ALL THIS EFFORT

These are just some of the trials that are now under way in *The Department of Agriculture* at Ambassador College, Bricket Wood, and others will be added in the future.

All of this activity is helping us to recapture some of the *"true values"* we speak of so frequently. At the same time it is equipping us to explain the *"RULES"* of our God-given environment to *you* and to *the world,* through classes, letters, leaflets, booklets, the magazine, etc.

It is helping this Department to play its part in *"feeding the flock"*. It is acknowledged that we all need guidance in the areas of child-rearing, marriage, finance, etc., but is it not equally necessary for us to learn the truth about managing the broader aspects of our environment?

An ecologist is one who understands the relationship and inter-dependence of each part of his environment. In effect, do we not all need to become ecologists?

One author put it this way:

> "Unless the general citizenry catch an understanding of the whole scene of which they are part, they will not be fitted to participate in a solution of their own problems" (*Deserts on the March,* p. 164, Paul Sears).

In his Degree Ceremony address at Melbourne University, 1971, R. F. Downes stated:

> "You should be able to continue with your own self-education, not just for a few years, but throughout the whole of your career. Furthermore, you should not be content just to restrict yourself to learning more and more about the particular field in which you have been specially trained.
>
> "I am convinced that the educated people who will be *most useful to society in the future* will be those who are broadly enough educated to understand the languages of many disciplines, so that they can acquire sufficient knowledge of them to participate in an *integrated* approach to the problem of man in his environment" (*Journal of Aust. Institute of Agricultural Science,* June 1971, p. 166).

Does this *broad-based approach* to education sound like Ambassador College? Does the *life-long education process* sound like Mr. Armstrong? Does *man's need to think clearly relative to his environment* remind you of what has been continually emphasised in *Your Living Environment* throughout the past three years?

It has been our aim not only to inform you on what we are *learning* and tell you what we are *doing,* but also to stimulate you to seek added environmental knowledge on your own.

It is our hope that *The Department of Agriculture* and those whom it serves may continue together toward a better understanding of God's wonderful and inspiring creation!