



# AGRICULTURAL TEACHING IN PRIMARY AND HIGH SCHOOLS UNDER THE EDUCATION DEPARTMENT.

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### BRIEF REVIEW.

The last few years have been noteworthy for many changes in the system of State education in Victoria, not the least important being the desire to make school work as objective as possible, to invest it with reality, to bring it into touch with the home interests of the pupil. As so many of the people of the State are engaged in agriculture, special attention has been given to the introduction into the primary course of what will appeal to their children, and, while preserving its educational value, will be of use to them if they follow the occupation of their parents.

In pursuance of this idea, there has been produced—under the name of nature-study—a wide-spread interest in plant and animal life; a school garden has become a necessary adjunct of a school; teachers have been permitted to teach agriculture in lieu of the course in elementary physical science; and an officer has been appointed to supervise the agricultural work in which they are engaged. Thus, in a way that must commend itself as truly adequate, has provision been made for the boy in the country school.

Further, the problem of providing for the boy who has passed through all the classes in the primary school, and who has elected to engage in agricultural pursuits, but whose general education needs to be deepened and broadened, and whose parents are desirous that he should acquire some special knowledge of what he is about to cope with, has been met by the establishment of agricultural high schools—continuation schools with a specialized curriculum.

### PRIMARY-SCHOOL WORK.

#### HINTS TO TEACHERS OF AGRICULTURE.

By J. P. McLennan, *Supervising Officer of Agriculture.*

Agriculture is being taken up in many schools instead of the elementary experimental science prescribed in the "Course of Free Instruction"; and several teachers who are just beginning the work have expressed a desire for information as to the manner in which the subject should be treated.

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These notes are intended to serve as hints and suggestions, and as an indication of the general scope of the work. Teachers who have read Bailey's *Principles of Agriculture*, or other good text-books, many of which are easily procurable, will have gained sufficient information to enable them to draw up a series of lessons and to carry out suitable experiments. Much useful information can be obtained from the weekly papers, the *Journal of the Department of Agriculture of Victoria*, *The Garden and Field*, and similar publications.

The work should, to a great extent, take the form of experiments and demonstrations, most of which will be carried on out of doors. From an educational point of view, the subject should prove of value, as the habit of observation will be fostered and the power of drawing deductions increased. There should be a gain to the community, too, from the utilitarian standpoint, as the knowledge obtained during the last two or three years at school ought to prove of practical value in after life.

The chief object should be to teach the fundamental principles of agriculture; for this purpose, a series of lessons should be given on the soil and its cultivation, and the plant and its requirements.

It should be noted that agriculture can be correlated with other subjects in the programme, as arithmetic, composition, geography, and health lessons.

#### THE SOIL.

In dealing with the soil, I would suggest the following lessons, amongst others:—How soil is formed, general classification of soils, soluble and insoluble food in soils, transportation of soils, humus, texture of the soil, moisture in the soil, moisture-holding capacity of the soil, capillarity, and the conservation of moisture. (These matters are suitably treated in Bailey's *Principles of Agriculture*.)

#### THE PLANT.

Very little botanical knowledge will be required in dealing with the plant. The information gained in the nature-study lessons in the lower classes will be of great benefit now. The most important points to notice will be the modes of reproduction and the way in which the plant obtains its food. Lessons should be given on fruits and seeds, roots, and leaves.

The propagation of plants should be dealt with.

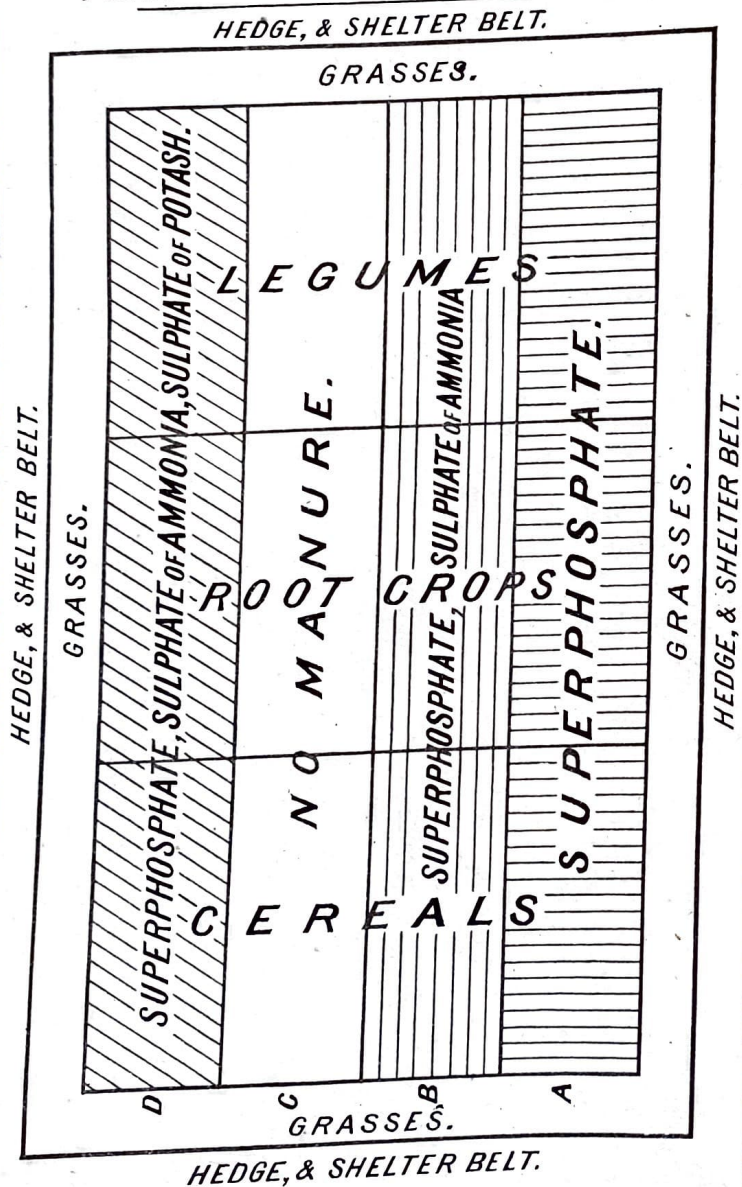
CULTIVATION.

The methods of tilling and enriching the soil, and preparing the land for the seed, will be noted, mainly by means of demonstrations and experiments.

EXPERIMENTAL PLOTS.

The accompanying plan has been decided on as the most suitable. The main plot should be in the form of a rectangle, 165 feet long by 66 feet wide, where possible. It should be divided crosswise into four strips of equal width; along these strips, the manures should be "sown" from end to end of the plot. The arrangement of the different manures will be seen on reference to the plan. It will be noticed that one of the strips is left unmanured, and is the basis on which comparisons between the various strips are made.

PLAN OF EXPERIMENTAL PLOT.



The crops should be sown in strips at right angles to the direction of the manure strips; by this means every crop passes across every kind of manure. Each of the

three kinds of crops occupies one-third of the plot. The cereals are sown in one division, the legumes in the second, and the legumes in the remaining division. This arrangement will enable rotation of crops to be practised; in the second year's operations, the legumes will take the place occupied this year by the cereals, and the cereals that occupied by the legumes.

A plan of the plot should be kept, and a record of the times of sowing and observations on the progress of the crops. The results of the experiments should be preserved in a tabulated form. In addition to the experiments in connexion with manures and various crops, other very interesting and useful ones may be undertaken, e.g.—good and bad tillage, thick and thin sowing, deep and shallow planting, drainage, irrigation &c.

Where practicable, it would be useful to have an extending right round the plot sown with various clovers, and lucerne. Then the whole might be enclosed by a hedge and shelter belt of shrubs and care being taken that they are not too close to the plot. Wattles, pepper trees, and sugar gums would be suitable for the shelter belt.

THE SEASONS.

As far as possible, the lessons should be given at the time of the year in which the operations described are carried on. A lesson on the methods of handling, for example, would be given about the time that the crop is gathered in.

AGRICULTURAL MUSEUM.

It would be useful to have a collection of soil exhibits illustrating the stages in the formation of soil from the rock to ordinary surface soil. The children should be encouraged to collect specimens of weeds and insect pests to be mounted and named for future reference.

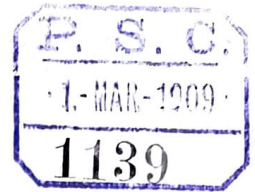
SCHOOL GROUNDS AND GARDENS.

It is only of recent years in Victoria that the educational value of the garden as an adjunct of the school has been recognized. Hereunder is given a brief resumé of the action taken by the Department to encourage gardening in State schools.

In 1901, the Minister of Public Instruction (Hon. G. Gurr) decided to award annually two prizes (£5 and £25 respectively) in each inspectorial district (there were 23 districts) for the most effectively-planted and best-kept school grounds, in the care of which the pupils took a part. Prizes were again offered for competition in 1902, and a stimulus was given by an order from the Director, requiring district inspectors to bring under the notice of the Department cases where teachers displayed great interest in beautifying and improving the school grounds. The Department's appreciation of the work done is then noted in the teacher's record, and a commendatory letter sent to the teacher.

In 1903, the Australian Natives' Association displayed great interest in this matter by offering a prize of the value of £100 for the best-kept ground in each inspectorial district. The offer was gratefully accepted, and it was decided that in the future, the Department would offer certificates (first and second class) in lieu of money prizes, as previously. As a result of this change, 51 first-class certificates and 40 second-class certificates were issued for the year 1903. The offer of the prize has been repeated from year to year, the presentation of the prize being generally made a pleasing feature of the school celebration.

As an indication of a growing interest in gardening in schools, the following comparison of the number of certificates



The Results of the Revolution (Bill of Rights, Act of Settlement, &c.), pp. 688-691.

The Philanthropic Movement. Pp. 739-741.

The French Revolution and the Napoleonic Wars (Pitt, Nelson, and Wellington). The Union with Ireland. Catholic Emancipation. Pp. 787-836.

N.B.—For the civics of Part II., "The Citizen Reader" (Australian edition), and for the subjects included under Australian history, Long's "Stories of Australian Exploration," are recommended.  
(See note e.)

Drawing I.—

*Practical, Plane, and Solid Geometry:* As for Classes III., IV., V., VI., and such problems as are contained in J. H. Morris's "Geometrical Drawing for Art Students," omitting Chapter XIII. and all but the first ten problems of Chapter XIV.; or Angel's "Elementary, Plane, and Solid Geometry," omitting the chapters on "Areas" and "Graphics"; or Spanton's "Geometrical Drawing and Design."

Music—

"The Rudiments of Music" and "Catechism of Music," by Professor Peterson, are recommended. Curwen's "Companion for Teachers," and Sutton's "Elements of the Theory of Music," will be found equally useful.

#### NOTES.

(a) Arithmetic and Algebra.—O'Mara's "Reasoned Methods in Arithmetic and Algebra" will be found useful.

(b) Mental Arithmetic.—Questions to be solved in a specified time will be set to all candidates. In addition, candidates will be required to show that they can state, explain, and illustrate rules for easy mental calculation.

(c) For junior teachers to be examined *specialy* the work will be as prescribed for the previous December examination.

(d) Geography.—Candidates should carefully study Gregory's "Geography of Victoria," as far as it bears upon the work prescribed, and should show an intelligent knowledge of, and ability to apply, the principles and facts therein set forth. Candidates for Part II. should read Chapter XIII. and Appendices A and B of Tarr's "New Physical Geography." A knowledge of minute topographical details will not be expected, but candidates should be familiar with all places that, from time to time, attract public notice, e.g., Waranga, Kingston, San Francisco, Trawool.

(e) (1) In history, candidates will be expected to answer questions on the geography relating thereto. (2) A satisfactory knowledge of both English and Australian history will be required for a pass. (3) Candidates for History, Parts I. and II., should note the reduction in the amount to be read in Green's "Short History of the English People."

(f) In the theory and practice of teaching, candidates will be expected to show that they are acquainted with the *Regulations*, and with the articles on school management and the art of teaching in the *Education Gazette* for the preceding twelve months.

(g) Drawing, Part I.—Teachers and candidates are recommended to consult Ellis A. Davidson's "Linear Drawing and Projection" for the information they require upon isometric projection.

(h) French and German. The text-books prescribed under French and German will, in all probability, be changed for the examination to be held in December, 1909.

(i) Layng's "Euclid, Book I." will not be recommended for the examination to be held in December, 1909.

N.B.—(a) Candidates for First-class Certificates and Junior teachers who present themselves for more than one class, and all monitors, must give notice to the Department not later than the 1st November in each year of their intention to present themselves for examination.

(b) Head teachers are requested to direct the attention of their junior teachers and monitors to the contents of this circular.

## AGRICULTURE.

### AGRICULTURE IN STATE SCHOOLS.

By J. P. McLENNAN, *Supervising Officer of Agriculture.*

I find that the three commonest mistakes made by those who are commencing to teach Agriculture are:—(1) Attempting too much; (2) indefiniteness of aim; and (3) merely giving information instead of experimenting.

Agriculture is a subject that covers a good deal of ground, and much thought is required in deciding what to deal with, and what to leave out. Most of the schools in which agriculture is taught are manned by fifth or sixth class teachers. Classes IV., V., and VI. are combined, and the standard adopted is what would probably be thought necessary for the Class V.

It cannot be expected that fully equipped "farmers" will be turned out from the schools, and I do not think that such is the intention. I take it that the training given in experimenting and making observations is of more importance than the actual facts learned, although incidentally a good deal of useful information about soils, cultivation, seeds, and farming operations generally will be gained during the progress of the work. A course of lessons should be mapped out at the beginning of the year, and the subjects chosen should be those that can be treated experimentally, or, at any rate, practically. The soil and the many problems connected therewith, owing to their importance to the farmer, will form the subject of many of the lessons.

The first lesson will probably be the mechanical analysis of the soil by the children. This work should be done accurately, and the percentages worked out. In this, and in many other lessons, agriculture can be correlated with arithmetic. The important point to notice when dealing with the component parts of the soil is that the gravel, sand, and clay (or whatever else they may be) are particles of different sizes. The importance lies in the fact that some of the important properties of soils depend on the size of the particles.

There would then follow an out-door lesson on the formation of soils. The class would be taken to a quarry, railway cutting, creek, or some other spot where the gradual transformation of solid rock into soil could be seen. Transported soils would be dealt with also. This is a lesson in geography as well as one in agriculture.

Next follows a series of lessons on the water-holding power of soils, capillarity, break of capillarity (by keeping the top soil in a state of fine tilth), percolation of water, drainage, burning humus out of soil, effect of humus on water-holding power of soil and on plant growth, &c.

These can be demonstrated by carefully conducted experiments. The experiment should be the central idea, and not merely an incident in the lesson. The pupils will draw their deductions from what they have observed, being assisted by skilful questioning on the part of the teacher. There will be many experiments with moisture, each experiment forming the basis of a talk or lesson. By these means, it will be shown that moisture is necessary for the plant, also that too much moisture is injurious, to most plants at any rate, especially if it is stagnant.

The next thing is to ascertain why moisture is necessary. Experiments in the water culture of plants are useful here; these experiments can be used to ascertain the essential plant foods. The experiments in connexion with the essential plant foods are really the only ones that need cost the teacher anything; the necessary chemicals can be purchased for a few shillings from a chemist. In conducting other experiments, jam tins and two or three Bismarck lamp chimneys are required, with the addition of a few pickle bottles and fruit jars. An experiment to show osmosis would be performed to explain how the soil moisture, with the plant food in solution, passes into the root.

The passage of the water through the vessels up to the leaves, and the way in which the plant gets rid of the surplus moisture, can be shown practically in an easy and interesting manner.

Here there is a danger of dealing too fully with the functions of the plant by discussing root-pressure, &c. Although this is an interesting and, in some respects, an important matter,

it appertains to botany rather than to agriculture; and it must be kept in mind that we are dealing with agriculture. Let us utilize botany and other sciences as far as they will help us to understand agriculture, but here is just where I have noticed the most frequent mistakes. Botany is a fascinating subject, and there is just the danger of giving too large a dose of it.

Most of the botanical knowledge required for State-school agriculture will probably have been gained in the nature-study lessons in Classes II. and III.

A good knowledge of the root-systems of plants is necessary. A knowledge of root-systems of various plants and of soils will assist in determining whether a plant would probably suit a certain locality or not. Without this knowledge, it might take many years to find out that a plant (especially a tree) is unsuitable for a given locality.

The fertilization of flowers is one of the most interesting and most useful branches of botanical work. Artificial fertilization has its practical use in improving species and producing new varieties; but I do not think it should take up much time, if any, in our schools. It would probably be dealt with fully in the agricultural high schools and the agricultural colleges.

Germination of seeds should be shown practically behind glass, the larger the face of glass the better. The best I have seen is a sheet of glass let in to the side of a kerosene case. The conditions for successful germination (air, warmth, moisture) should be shown experimentally.

Most of the foregoing is indoor work, and deals with what may be termed the principles or theory of agriculture, although much of the work in the plots deals with the principles as well as the *art* of agriculture. The pupils *do* something; they observe, and then make their deductions. The work in the plots is of course closely connected with that done inside, and, in many cases, is a practical demonstration on a more extensive scale of what has been dealt with inside. This applies especially to problems relating to the conservation of moisture, and includes tillage, what good tillage means, benefits of good tillage, &c. In the plots, the work should all be experimental, and every experiment should have a definite aim. It is not sufficient to grow a patch of maize simply to watch it growing. It is better to test (a) whether drilling or broadcast sowing produces better results; (b) whether surface cultivation between the rows is beneficial; (c) for benefits from pruning; (d) for best variety or varieties for a given locality; (e) for best depth for planting; (f) for best times for planting, and so on. This provides for the crop being sown under varying conditions, and there is always a contrast, a comparison to be made, and a simple deduction to be drawn. The above list does not exhaust the number of experiments that can be carried out.

During the present year, in most cases, the soil has been treated with a number of different manures. When the crops are gathered in, and carefully weighed and compared, it will be ascertained whether the soil is deficient in phosphoric acid, nitrogen, or potash, or any two, or the three of them. This practically amounts to a rough chemical analysis of the soil. Some teachers deal with one of the following:—Bee-farming, milk-testing, economic native woods, fibre plants, or silage. In every case, the work is practical, and is an adjunct to the course on the general principles of agriculture. In a few schools, a collection of grasses is grown, chiefly for purposes of identification, but also to ascertain the most suitable ones for the district.

There is probably sufficient mentioned to provide for a year's work. It is all practical; it is not a matter of simply reading or lecturing from a text-book. In one school, the theoretical work consisted of the reading of Kirk's *Principles of Agriculture* by the class. They were reading about nitrites and nitrates, ferrous and ferric oxides, &c.; of course, they were just wasting time.

In agriculture, more than in any other subject, the teacher must make the text-book his slave, he must not be the slave of the book. There are several text-books, however, that a teacher might read with advantage.

This subject is new to teachers, in fact to most of us; the wider the outlook we have, the better will we be able to decide what to deal with and how to proceed.

With regard to notes and records, I am pleased to say that most of the teachers I have met recognise their value. Without records, the work in agriculture will lose much of its value. In some schools the records are more exhaustive than in others, and one can lay down a rule as to how much should be recorded. I strongly recommend teachers to see that the records are the individual work of the pupils—that they are not copied from the black-board. The pupils should draw the plots to scale, thus correlating agriculture with drawing. This subject can also be correlated with history, English, and health lessons.

I know several farmers who have plans of their farms put to scale and note the uses to which the various paddocks are put. This is a great aid when carrying out rotation of crops.

If agriculture is carried out on the lines I have indicated, plenty of opportunity is afforded of training and developing the observational powers and the faculty of drawing conclusions. Then the children will acquire the habit of experimenting and finding out for themselves—results that will be especially valuable to those who follow farming in after life. They will also realize that work on the farm need not necessarily be all a drudgery, but that there is plenty of scope for intelligent work. Besides, the work in agriculture being dealt with in school will probably impart to it a dignity that it has not always possessed at least in the eyes of many people. I regard this as very important; of course, the agricultural high schools, colleges, and Universities assist further in giving that dignity to the farm that it deserves.

Already, in some of the schools, information valuable to the community has been gained from the experiments in plots. There are many indications that, through these, where agriculture is taken, a better understanding is being established between the public and the teachers. This better feeling towards the schools is probable general and has likely resulted from other causes as well, but it is particularly noticeable in the cases of the schools I have visited in the course of my duties.

This is evident from the many cases in which the plots have been given, the plots cleared and prepared, sowing, wire-netting provided, grounds fenced in, shelter provided, &c. My information is not all gathered from teachers, but directly from residents whom I have spoken to on the subject.

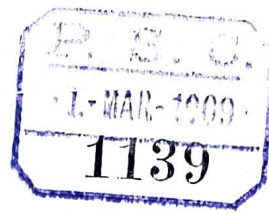
Tree-planting has been carried out at nearly all the schools I have visited; at a few schools only has little or no work been done, and then generally because the school grounds have been unfenced.

Usually the trees are well cared for, the surroundings being dug and kept clear from grass and weeds, and protection from rabbits and stock being provided where necessary. At some of the schools, the teachers raise the trees from seed. This has many advantages. When the trees are raised from seed, they are practically acclimatised, there is no risk of injuring them, and only the healthy and best trees are utilized. As a rule, the surplus plants are given to the parents.

In some cases, I am sorry to say, that trees planted by teachers have been neglected by their successors. This remark applies in the case of a few of the schools where I have been.

In most cases, however, the teachers are introducing a new class of gardening. The old style of formal square lawns, long, grave-like mounds will soon be a thing of the past. Curve lines, with round or oval beds, are frequently adopted.

Better still, picturesque or landscape gardening is being adopted by some teachers. It is being recognised that the simpler the design the less trouble will there be in keeping the edges and corners in a neat condition. More satisfactory will be the result generally. My advice to teachers is not to attempt too much, but to garden well kept is more effective than a larger one that is not from rabbits, but from the children, and (in some cases) to have the gate locked. At the schools where I have been, the best gardens, the children have had perfect freedom of walk in and about the garden when they choose, without causing destruction, the children rather see that



destroyed, and do any little thing that seems necessary. In these schools, gardening has a great influence for good.

Our schools can exert a great influence for good in the matter of tree-planting, the importance of which has been specially brought home to me during my journeys in the northern and western districts of the State.

#### NOTES AND SUGGESTIVE EXPERIMENTS.

To commence with, spread out a small portion of soil on a piece of white paper, and examine it carefully. It will be found to consist of a great number of particles of varying sizes and colours. Many of the important properties of soil are due to this variation in size and colour. See whether these particles are all composed of the same materials. To do this, some simple experiments will need to be made.

EXP. 1.—Place some soil, say four tablespoonfuls, in a jam tin; cover this with pure rain water, and boil for ten minutes. Then filter, and evaporate to dryness over a spirit lamp the portion that passes through. The sediment that is left after evaporation is the "water soluble" part of the soil.

EXP. 2.—Take the same quantity of soil as in the last experiment, place it in a jam tin, or beaker, and pour over it the same quantity of water as before. This time, add an ounce or two of hydrochloric acid (spirits of salts, or muriatic acid), and then boil. Notice whether any bubbling takes place when the acid is poured on. If the amount of effervescence is great, plunge a lighted match into the beaker, and see whether the light is extinguished. The bubbling is an indication of the presence of lime. After boiling for five or ten minutes, filter, and evaporate to dryness the portion that passes through. If lime or iron be present, the amount of sediment will be much greater than in the previous experiment.

EXP. 3.—Weigh out 10 to 20 grains of dark soil; place it in a saucer, or evaporating dish, and dry over a jam tin of boiling water for an hour; then weigh again; it will probably weigh less. The loss of weight is owing to water being driven off.

EXP. 4.—Take several pounds of surface soil, place in an old frying pan, and dry thoroughly. When the moisture has all been driven off, weigh, and heat thoroughly over a hot fire, and weigh again. The loss in weight this time will be due to the burning out of the organic matter (humus). Besides noticing the loss of weight, the children should observe any change in colour. This burnt soil might be kept for future tests.

NOTE.—When drying soil, care needs to be taken that all the moisture is driven off; this is done by repeated weighings, until, at last, no difference in weight can be noticed.

The results of experiments 1, 2, 3, 4 show that a portion of the soil is soluble in water, another portion in acid, that a part consists of organic matter, and that water is present, although not able to be seen.

EXP. 5.—A simple and easy way of mechanically analyzing soil. Carefully weigh 4 or 5 lbs. of typical local soil; have two vessels at hand, one large (a kerosene tin will do), the other smaller (say, a dipper).

Put the soil, after being crumbled, in the smaller vessel, cover with water, and shake or stir vigorously. Allow it to settle for a second or two, and pour off the muddy water into the larger vessel. Pour more water over the material left behind, allow to settle slightly, and pour the muddy water into the larger vessel as before. Repeat this until the water comes off clear.

Place the larger vessel aside, and leave it until the material in suspension settles; then siphon off the water, and dry the sediment; also dry the material that was left in the smaller vessel. The material that settled in the larger vessel is clay, the other material is sand, or perhaps sand and pebbles. Weigh each part, and work out what percentage of the soil each represents.

This is a "rough and ready" method, and fine sand may be included with the "clay."

The following is a plan of more accurately dividing the soil particles into groups, so that each group will contain particles of approximately the same size:—

EXP. 6.—If the soil is gravelly, punch some fairly large holes (say, 5 mm. in diameter) in a jam tin, another lot of holes (say, 3 mm. in diameter) in a second tin, and in another tin holes, say, 1 mm. in diameter. Sort the particles out in this

way. The particles that will not pass through the holes 5 mm. in diameter may be called *stones*, those that will not pass through 3 mm. *coarse gravel*, and those that will not pass through 1 mm. *fine gravel*.

EXP. 7.—The soil that passes through the smallest holes is then put into a beaker or glass, and water is poured on. Now stir, and allow to settle for, say, half a minute. Decant the portion that has not settled into a larger vessel. Pour water into the beaker again, allow to settle for half a minute, and decant again. Repeat this until the water becomes clear when standing for half a minute. The material left in the beaker is *coarse sand*.

EXP. 8.—Now take the soil and water that was decanted off, stir, allow it to stand for five minutes, and then decant off. Continue this until the water above the soil becomes clear after standing five minutes. The material left behind might be termed *fine sand*.

EXP. 9.—The liquid that was poured off is again stirred and allowed to stand for 24 hours, and then decanted. Repeat the operation. The material that settles is *silt*; that which does not settle is *clay*.

#### SEEDS FOR AUTUMN SOWING.

Teachers who are taking agriculture should inform the Supervisor of Agriculture what seeds they require for the autumn sowing. Their requests will be granted as far as possible.

In most of the plots, the same manures as were used last year will be applied again. The root crops will occupy the ground taken by the legumes last year, the cereals that taken by the roots.

It is hoped that the seeds and manures will be forwarded shortly.

Mr. McLennan's address is No. 10 Chaucer-street, Moonee Ponds.

#### STATE-SCHOOL AGRICULTURAL PRODUCTS AT THE MELBOURNE SHOW.

Teachers in schools at which there are experimental plots are reminded of the proposal to have an exhibit of the products grown at State schools at the Royal Agricultural Show, to be held in September next. The schedule of prizes was printed in the supplement of the September issue of this paper.

### SELECTED ARTICLE.

#### HOW TO MAKE AUSTRALIAN POETRY HELP US TO TEACH AUSTRALIAN GEOGRAPHY AND PATRIOTISM.

Alice Reilly, Leichhardt Infants' School, N.S.W.

Might not the teaching of patriotism in the right way to children of seven and eight years of age be as important as getting them to write at the rate, of, say, sixty words a minute? If I remember rightly, Mr. Inspector Smith and Senior Inspector McLelland were bewailing, in one of their annual reports, that the teachers in their districts rang the changes on two Australian poems—"Harry Dale, the Drover," and I forget the other. This was the independent experience of these two inspectors, working separate districts. Surely our literature is not as poverty-stricken as all that. Why need we be always going to the Greeks and Romans and Germans for our heroes? Have we not any of our own who have been doers of fine deeds? "The bush" is nothing but a vague term, to most of our town children at all events. Have not some of our own poets, who knew and loved it, peopled it with our own heroes—the men and women, too, out back on the "plains of the Never Never," who face the drought, and the heat, and the uncertainty, and awful loneliness of the bush—that life in the towns might be the easy and pleasant thing it is for us. What are any of us doing to teach our children love for their country through a love for its literature? There are those who look into the future, who tell us that before those children we are training to-day to fight the battle of life are grey-headed they are likely to want all the patriotism they have got, and more, too.

We have fine, stirring pictures of Australian life and Australian deeds. Why cannot we give our own literature a chance of making our own children acquainted with the conditions surrounding them? We have on all sides hungry nations regarding us with covetous eyes, and we would not be doing our children any harm by teaching them that this, the land of their birth, is a country well worth living in, and when the time comes (as it surely will) worth dying for.

Our scheme of work for the final term of this year is one of man's primitive needs—clothing. I was puzzling out the programme when I got an idea from two things—a mob of sheep and a poem by A. B. Paterson. You will say: "Where is the need to worry over the construction of a programme? You can buy heaps of books containing ready-made programmes." And so I can; but that is not just it. Your scheme, if it is to have any educational value at all, must fit your own conditions, and the environment of your children here in New South Wales is not exactly that of the children in England or America.

On coming to school one day I saw my particular inspiration standing in a by-street. It was a mob of sheep that had evidently come a long distance, for they were too tired to go on. I made a bee-line for the school, and the children, who had just gone in, were drafted out in squads to see those sheep at close quarters, and talk about them; and what they saw and what they said would fill another paper.

One boy who was late was sent back to look too. When he returned I saw him thrust something into the teacher's hand. I saw her nose go up, and the corners of her mouth go down, and the Thing dropped to the floor. He told her it was wool from the sheep's back. How he came by it I did not inquire. It was not exactly the stuff ladies knit fascinators of; but it had the merit of being the real thing, and it was not putting on any "side." So we disinfected it, and put it by for future reference. Now the question was to find a more suitable setting for those sheep than that afforded by a vacant lot at Leichhardt. So New South Wales, as seen through the eyes of Paterson, Kendall, and Lawson, would furnish this. "Where did these tired sheep come from?" From a long way up country—a place called Kiley's Run—and the drover was Clancy, of The Overflow. How did I know? Why, a man in Sydney told me. What was his name? Well, they call him "Banjo" Paterson. In fact, he was the man who wrote for the *Evening News*. They were getting nearer now. They knew all about the *Evening News*. So I told them they had only to call at his office any day they found themselves in Sydney, and he would tell them all about it, for he had been there, and Clancy was a mate of his.

Would they like to know what the place these sheep came from was like? Yes. Well, we would write it on the board, and they could find out for themselves. And then they read:—

"The roving breezes come and go  
On Kiley's Run.

The sleepy river murmurs low,  
And far away one dimly sees,  
Beyond the stretch of forest trees,  
Beyond the foothills, dusk and dun,  
The ranges, sleeping in the sun  
On Kiley's Run."

They were intensely interested in Clancy. You see, he had been a mate of the man who wrote for the *Evening News*, and some of them sold the *Evening News*. Was not Clancy the mate of the man who was in a sense their boss? What could I tell them of Clancy? Well, I would write on the board what Mr. Paterson told me about a letter he had once written to Clancy, and they could read it themselves:—

I had written him a letter,  
Which I had, for want of better  
Knowledge, sent to where I met him,  
Down the Lachlan, years ago.  
He was shearing when I knew him,  
So I sent the letter to him,  
Just on spec, addressed as follows—  
"Clancy of The Overflow."

Now, as we wanted to see where Clancy had been shearing, and where The Overflow was, the best thing we could do was to have a picture of these places. And would not a picture made by themselves be the best sort of a picture? So the teacher of the class, a girl not yet 20, but the making of a fine, en-

thusiastic young teacher, entered thoroughly into the spirit of the thing; and we all set to work to make New South Wales in the front garden between two flower-beds. We had the Great Dividing Range out of a heap of stones we had down the yard. (We never waste anything.) We stuck the pegs, Sydney, Newcastle, Grafton, Wollongong, and our coast with a layer of sand; beyond that was the Pacific.

Where the might of a world-wide ocean  
Round the youngest land rolls free.

[All the poetic extracts given in this paper were read for the term.]

We found Kiley's Run, and built the homestead, the huts, fenced in the paddocks with pegs, twine took the wire. We made netting to keep out the rabbits, sunk an artesian bore, made a travelling stock route, and forgot the reserves.

They were wanting to know if Mr. Paterson had been Clancy. So they read—

And an answer came, directed in a writing unexpected  
And I think the same was written with a thumb-nail  
in tar.

They liked that. And why was it written "with a nail dipped in tar"?

'Twas his shearing mate who wrote it,  
And verbatim I will quote it—

"Clancy's gone to Queensland droving, and we do not  
know where he is,"

They asked me: "Why couldn't he have said, 'I know where he is'?"

And now Clancy had turned up here in Sydney, by our map what a long distance he had travelled, after leaving his sheep at Glebe Island (where they turned into mutton, some of which would be frozen to England, to feed the people there), he was talking a mob of yearlings to the run, and we were going back. So we said good-bye to Sydney, and set off with Clancy in charge—Clancy

With his cabbage-tree hat on the back of his head,  
And the string of it under his nose,  
And Rover—one-eyed Rover—  
A grave old dog, with tattered ears,  
Too sore to cock up, reader,  
A four-legged hero, full of years,  
And sturdy as a cedar;  
There was no better sheep-dog in the whole country  
than eyed Rover.

On we went past Parramatta, over the Blue Mountains  
Leura, Katoomba, and Blackheath. Some of them had  
there, where the gums in the valley stand gloomy and  
Past the wonderful valleys and gorges; past the "deep  
gracious glens." We saw—

That gleamed between the wet green walls.  
High places that knew of the gold and the white  
On the forehead of morning.

And as we went we talked of the men who had first  
glorious, for—  
The way past these wild, beautiful places. The weather

Grey Winter hath gone like a wearisome guest,  
And behold! for repayment September comes in,  
wind of the West,  
And the Spring in her raiment —

And September, too, had gone, and spring would be gone  
long, for we were now in October. And we read—

October, the maiden of bright yellow tresses,  
Loiters for love in these cool wildernesses,  
Then is the time when the water moons splendid  
Break with their gold, and are scattered or blended  
Over the creeks, till the woodlands have warning  
Of songs of the bell-bird, and wings of the morning

We were well on our way to Bathurst, the City of the  
now, and we feasted eyes and ears on—  
The gold of the grass, and the green of the wheat  
And the music of wind and of water.

Soon Bathurst lay behind us, and at night we heard—  
The bells along Macquarie  
When the dark begins to fall.

## AGRICULTURE.

By J. P. McLENNAN, *Supervising Officer of Agriculture.*

### SUGGESTIVE NOTES AND EXPERIMENTS.

As the result of the mechanical analysis, the soil is divided into groups according to the size of the particles. Now, let us see what can be learnt from this.

Let us suppose that the soil consists of stones or coarse gravel, and that the stones are cubical in shape. If we had a cubic foot of stone, each edge measuring one foot, we would have one particle, the surface of which would be six square feet. If we divided this into eight equal parts, there would be eight particles having a total surface of twelve square feet. If the cubes were again divided the total surface would become still greater.

If the particles were spheres, the number of particles in a given volume would increase inversely as the cube of the diameter of each particle, and the surface would vary inversely as the diameter,—provided that the spheres were placed on top of one another in such a manner that their centres were vertically over one another, in the following manner:—



So we see that the smaller the particles the greater will be their number and the greater will be their total surface in a given volume of soil.

*Exp. 10:*—To test for the water-holding capacity of different soils—Get two bottles, with the bottoms cut out, and tie linen over the mouths. Put the same quantities of coarse sand and clay, respectively, in each. See that the sand and clay are dry, note the weights and pour equal quantities of water over each. Stand for some time so that the water will drain through the linen, and weigh occasionally. When no more water will pass away, weigh carefully, and note which holds the greater quantity of moisture.

The scope of this experiment can be enlarged by experimenting with fine gravel, coarse sand, fine sand, sand and clay mixed, and clay.

*Exp. 11:*—Capillarity.—If glass tubes with different sized bores are available, show with coloured water that the smaller the bore the higher will the liquid rise.

*Exp. 12:*—Get four Bismark lamp chimneys and fill them with fine gravel, coarse sand, fine sand, and clay, respectively. Tie linen or muslin over the bottoms. The materials must be quite dry. Stand them in a dish of water, and note the height to which the water rises in each case.

On the size of the particles depend the water-holding capacity and the capillarity of soils.

*Exp. 13:*—Place a layer of salt in the bottom of a glass; then fill the glass with damp sand or clay. After a time the salt will be found on top. Why?

*Exp. 14:*—Percolation.—Take three pots or tins and place in each equal quantities of dry sand, sand and clay mixed, and clay, respectively. Note the time it takes a given quantity of water to pass through each; from *Exp. 10* it will be seen that some of the water will be held by the soil, only part of it passing completely away.

*Exp. 15:*—Take a portion of the soil from which the humus was burnt out, as explained in *Exp. 4*, and test its water-holding capacity as compared with the same quantity of soil before it was deprived of the humus.

*Exp. 16:*—To show availability of plant food at different depths of ordinary soil—

- (a) Carefully scrape the soil from the top inch; it should contain a good deal of humus.
- (b) Take the soil from the next inch; this will probably contain less humus.
- (c) Take the soil from the third inch.
- (d) Collect the same quantity from the next inch.

Place these four samples of soil in four pots or tins; sow a grain of wheat or barley, or a bean, in each, and note developments.

*Exp. 17:*—Place equal quantities of rich garden soil and the same soil with the humus burnt out in two pots or tins. Sow a seed in each, and note developments. In this and the previous experiment, the plants can be grown under natural conditions by placing the tins in a trench in the garden, having the tops of the tins level with the surface of the ground. Care must be taken that the tins are properly drained, and that they are protected so that foreign matter will not be carried by the wind and be deposited on the soil that is being experimented with.

The following extract is taken from Bulletin 152, issued by the Ontario Department of Agriculture, dealing with Agricultural Experiments at schools.

“The advantages of the work, after twenty years' operation, are thus summed up:—

1. It systematizes seed distribution along definite lines and for valuable purposes.

2. It supplies a direct, as well as an indirect, source of information.

3. It enables practical men to obtain information regarding varieties of field crops, selections of seed, dates of seeding, methods of cultivation, ways of increasing soil fertility, &c., for their own particular farms, which they could not get in any other way.

4. It enables farmers to get a supply of pure seed of the leading varieties of grains and potatoes, which rapidly increases in quantity, and thus furnishes seed for sowing and planting on large areas and for selling at good prices.

5. It educates along the lines of careful handling and close observation, accurate calculation, and economical methods.

6. It trains men to unite science with practice, and to lead other men to do likewise.

7. It helps farmers to understand better the scientific principles that they read about in bulletins, reports, and newspaper articles, and that they hear about at agricultural meetings.

8. It furnishes hundreds and even thousands of object lessons annually, which form centres for interesting study along the lines of progressive agriculture.

9. It supplies valuable topics and results for discussions in the field, at the fireside, in the grocery corner, and at meetings of farmers' institutes.

10. It stimulates the local papers to take a deeper interest in advocating better methods of farming.

11. It furnishes some exceedingly important results for printing and distributing in the form of bulletins and reports.

12. It adds dignity to farming and pleasures to farm life.
13. It exerts a wholesome influence in keeping the farm boys interested in farm work.

14. It leads to a substantial increase in farm profits, and to a steady advance in agricultural education throughout Ontario.”

### EXHIBITION OF STATE SCHOOL AGRICULTURAL PRODUCTS AT DISTRICT SHOWS.

It is expected that a good collection of the products grown on the experimental plots will be exhibited at the next Melbourne Show.

A knowledge of what is being accomplished by teachers in this work would be gained, if it could be arranged to have similar exhibitions at country shows.

No doubt agricultural and horticultural societies would be glad to set apart a portion of their space for this purpose, and would perhaps donate prizes for competition between the district schools. Besides the products of the experimental plots, the exhibits could include plans of plots (drawn to scale), charts showing the results of field experiments, samples of soils, the materials resulting from a mechanical analysis of a soil, collections of noxious weeds, economic woods, &c.

### FIELD EXPERIMENTS FOR 1908.

Owing to the lateness of commencing operations last year and to the dry season, the experiments in many of the plots were partial or complete failures.

At most of the schools, it is advisable to carry out similar experiments to those undertaken last year, the same manures being used at the same rate per acre.

At schools where the soil is naturally very fertile (as in the case of some of the schools in the Warrnambool district), the tests for manures might be discontinued and other experiments substituted, e.g., testing suitable fodder crops, testing varieties, showing benefit of selecting good seed, showing benefit of surface tillage, &c.

TEXT-BOOK ON AGRICULTURE.

Mr. M. E. O'Brien, head teacher of the Lancefield school, states that he will publish an agricultural text-book shortly that will be suitable for use in State schools.

ORIGINAL ARTICLE.

THE TEACHING OF HISTORY TO CLASS III.

"ACROSS THE BLUE MOUNTAINS."

By William Henderson, B.A., Inspector of Schools, Horsham.

History, or nation knowledge, differs from geography, or earth knowledge, in so far as the facts in the former are not present, and can never be present; while, in the latter, the facts are either present, or can be made present. Australia's history is bound up in the peaceful victories of her navigators and her explorers. Professor Gregory well puts the case when he writes:—"The victories in Australian history have been those of the engineer and the agriculturist. The heroes of Australia are not the men who have won fame at the cannon's mouth. They have had to fight a harder fight without the reward of even a bubble reputation. They are the unknown swagmen, who have tramped from Sydney to Fremantle to get an extra 2s. a day wages; or forgotten prospectors, who have discovered the mineral resources of the continent during feats of travel, which, if applied to arctic exploration, would long ago have carried them to the north pole."

How, then, are we to give our pupils a clear and connected account of the exploits in their homeland? Thanks to the camera and to the stereoscope, we are placed in possession of a fund of valuable graphic illustration that, better than all the words at our command, convey to youthful minds an adequate and accurate conception of the almost insurmountable barriers the pioneers had to overcome. The imagination must be cultivated, must be stimulated; so picture, chart, and diagram should invariably be consulted.

As a preparation to the study of this article, teachers are recommended to consult the notes on history to be found on pages 4, 15, 26, and 27, of *Regulations and Instructions*.

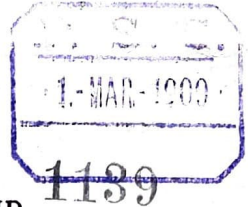
By means of the stereoscope, or through the medium of illustrated papers, the pupils are led to appreciate the rugged scenery of the Blue Mountains. A talk between teacher and pupils on the more important natural features of the subject serves as an introduction to historical detail. The whole lesson is to be built up, in full view, and with the active co-operation of the class. Begin by asking a child to draw, on the blackboard, the simplest boundary line of New South Wales. The drawing of the northern, coastal, and southern boundaries follows in that order. The positions of Sydney and of

the Blue Mountains are next fixed. The map, drawn by the class, is then compared with the school map, and all necessary corrections are made. The subject lesson is clearly printed or written on the blackboard, then follows the construction of the segments. Composition is taught incidentally, the teacher selecting from numerous answers the most expressive to set on records. The connexion between Governor Macquarie and the Blue Mountains is first considered, and pupils may be encouraged to gather, from Macquarie's actions in this matter, some idea of his pioneering instincts. The reasons that prompted the Government to foster the expedition are next taken up; afterwards the actors are introduced to the pupils. That wonderful piece of mountain engineering—the Zig-zag Railway—conveniently concludes the series of six lessons required to suitably develop the subject. The information in the segments is merely the skeleton of the building up, on these bones, with flesh and blood, being the work of the skilful and resourceful teacher. The aim of the system is to give thoroughness to the teaching of history in Class III., and, though more than directive, the writer is, from experience, fully convinced of the educational advantages to be gained by a course of history pursued along the lines laid out. The arrangement of the matter serves to fix the attention on one central idea, around which, in imagination, are arranged adequate and accurate concepts. The segments in the segments serve a useful purpose in providing ample material for junior composition.

The information required for building up this and other lessons may be gathered from Long's *Stories of Australian Exploration*, from which book the children might, to great advantage, read the account of the incidents of the oral lessons have been given. A stirring reading recitation is a fitting termination to a history lesson.

CENTRAL IDEA:—ACROSS THE BLUE MOUNTAINS.

No.	Topic.	1st Lesson.	2nd Lesson.	Revision.	Method.
1	Talk about scenery of Blue Mountains	5/3 ...			Pictures, maps, views, etc.
2	Map of New South Wales	10/3 ...			Drawing, models, maps, etc.
3	Lachlan Macquarie	12/3 ...			Photograph, map for use
4	Reasons ...	17/3 ...			Oral description, assisted pictures
5	Blaxland, Lawson, Wentworth	19/3 ...			Oral description and map names
6	Zig-zag Railway	24/3 ...			Pictures, maps



## NATURE-STUDY.

### GEOLOGY IN RAILWAY CUTTINGS.

By *Physicus*, in the "Argus."

In a comparatively dry climate, like that of Victoria, those interested in geology have long been able to learn a good deal of the story of the rocks from what was displayed in railway cuttings. There are, however, a very large number of people to whom bare rock, unless it is artificially arranged round garden paths, or piled up into monstrosities, like those of the Alexandra-avenue, is distasteful. They prefer to have all irregularities smoothed away, and blanketed by turf or by plants not more than 3 feet high and ablaze with glowing colours.

There is, of course, a middle way, in which a steep slope can be judiciously planted, so as to show rock and shrub, as we see it in a natural cliff. To many people the restful green of a mountain valley is infinitely preferable to a blaze of mingled scarlets and purples and yellows, and a rocky crag is beyond rubies. A few years ago, the Railways Commissioners, by offering prizes, encouraged the beautifying of stations by planting trees and flowers, and, to the great majority of the travelling public, the innovation was a delightful one. Then came the idea of planting open spaces along railway lines, and places, like the bare and hideous waste between North Melbourne and the Moonee Ponds Creek, were transformed into beauty spots. Gardens sprang up near the signal-boxes at Jolimont, and on the Mordialloc line, and in many another place as well. Then came still another step, and ivy and mesembryanthemums (*et hoc genus omne*) began to festoon the railway cuttings and embankments. But, to cover all the cuttings with greenery was felt by many people to be a mistake, both from an artistic and from a geological stand-point. It must be remembered that tens of thousands of school children in the metropolitan district alone are nature students now, and many of them will retain much of their interest throughout life. They will be able to look on the rocky face of a railway cutting with some insight into its meaning. It is no longer a mere stone wall, but the edge, perhaps, of a lava sheet, that stretches for miles. The seeing-eye will picture the glowing molten rock, covered by its steam cloud, as it ran slowly down the gentle slope, and cooling and hardening as it ran. To the child who has been taught to see these things, the railway cutting near the Footscray station will no longer be an eyesore, to be hastily screened from the public gaze. He will be anxious to preserve it as it is, untouched by the rash hand of the decorative improver.

In the miles of railway cuttings about Melbourne there is, of course, a good deal that is not worth preserving, and a good deal that is mere repetition; these may well be handed over to the gardener, for we are not all geological students; but, surely, we should keep the more instructive cuttings in such a state that their story may easily be read.

A few months ago the subject was brought before the Field Naturalists' Club. A list of about a dozen cuttings was drawn up, which it was thought it would be advisable to keep un-planted. The Railways Commissioners were approached, and, to the delight of a great many people, they promptly agreed to reserve the cuttings, as desired.

In Alexandra-avenue there is a cutting through one of the most interesting bits of rock around Melbourne, but the club has not had much success in its attempts to preserve this. Perhaps further representations, backed by still further eloquence, may be successful in convincing those who rule these things that a flower garden is not everything, and that many people would visit the avenue merely to look at the few yards of bare rock, which it is now the aim of the gardener to cover.

One little thing should, however, still be done. The gardener thinks it well to label his trees, to tell their names, and mention their original home. The same plan should be adopted with the sections that are being preserved. They should be labelled "geological section," and in six words we should be told why the reservation was made. For the want of such a label, already one of the chosen thirteen sections has been spoiled, and a suburban council has approached the Commissioners, asking them to blanket another. The nature students, to employ the modern nickname, are a sufficiently large class

to expect that some, at any rate, of the sections, both natural and artificial, will be preserved for them, and that the laudable desire for beautification will not overstep its just bounds.

The most instructive of all the railway cuttings near Melbourne is undoubtedly that in Royal Park, near Flemington Bridge. The upper part of the cutting is in the rust-stained sands and gravels, which constitute the "red beds" which cap the hill tops of the suburbs, and form practically the whole surface of the country from Kew to Mentone. Here at Royal Park fossils can be found in the red sandstone, which clearly resemble shells now living on our shores. They show that what is now dry land was under the sea when they were alive.

Beneath these marine red-beds there are to be seen several mounds of fawn-coloured clay. The clay is really bluestone or basalt, which has decomposed where it lies. Nowhere near Melbourne can the whole series of changes from dense bluestone to soft clay be so clearly traced as in this cutting, and it is doubtful if a finer section could be found.

The mounds of fawn-coloured clay were once mounds of bluestone. This means that the originally level lava plain was cut into hills and valleys by running water, and this could only have taken place above sea-level. The little hillocks then are an old land surface, which was subsequently submerged for the formation of the red-beds. At one end of the cutting, just under the semaphore, is a little ridge of bed-rock, or silurian. It is not easy recognisable at first, but may be traced right across the floor of the cutting. We have then three sets of rocks shown, the bed-rock, bluestone, and on top come the red-beds. So that there is a bluestone older than the red-beds, and differing from the bluestone of Keilor Plains, Footscray, and Burnley, which is younger than they are.

At Footscray, in a cutting between the Saltwater and the station, the newer bluestone, or newer volcanic rock, as geologists call it, is well shown. The rude columnar structure, so characteristic of the lava, stands clearly out.

Away on the other side of Melbourne, at Windsor, between the station and Dandenong-road, the face of the cutting shows us the level layers of the red-beds, which geologists speak of as of tertiary age, overlying the highly-inclined layers of the old silurian bed-rock. The dark, rust-stained upper beds contrast well with the yellows of the older rocks, and everything is as clear as a diagram in a text-book.

Still one more cutting may be noticed, and that is just beyond the Jolimont station. Here nothing but bedrock is shown. We see the thin layers, thrown up on edge by the giant forces which have crumpled the ancient strata like paper. The changing currents of the ancient ocean now laid down great sheets of mud, and yet again wide banks of sand, and so we get the alternating layers of mudstone and sandstone, which are so conspicuous. The cutting is too narrow and dangerous to wander along, but when it was being made the remains, only fragments, it is true, of great extinct crustaceans were found, and their nature was recognised by the late Sir Frederick McCoy.

But thirteen cuttings are to be preserved for us. These are but samples of the lessons that may be drawn from their study, and will serve to show why so many people want to see bare rock, rather than bright flowers and greenery, in some, at any rate, of our railway and road cuttings.

## AGRICULTURE.

By J. P. McLENNAN, *Supervising Officer of Agriculture.*

### EXPERIMENTS.

To show the importance of moisture to the plant:—

*Exp. 18.*—Procure three large jam or fruit tins and punch holes in the bottom of one of them. Fill the tins with rich soil, and place a young plant (say a bean) in each. Of the two undrained tins, keep the soil in one quite dry and in the other quite saturated. Water the third occasionally, taking care that it is well drained. The pupils should watch developments, and note them in their books. When the plant in the undrained tin begins to look sickly and dies off, the cause should be investigated and noted. Then might follow a lesson on "drainage." The plant in the dry soil dies. Why? As the plant that was watered grew, the pupils are justified in concluding that absence of moisture was the cause of the dry one dying.

Instead of "telling" that the plant died because the plant food in the soil was not dissolved, it would be better to grow a plant with its roots in a solution of distilled water and nutrient salts.

*Exp. 19.*—Growing a plant in a nutrient solution.—Place a solution of nutrient salts and distilled water in a pickle jar. Cut a slit in the cork to hold the plant, letting the roots dip into the solution. Many nutrient solutions have been recommended. The following is taken from Strasburgh's *Text-book of Botany* :—

Distilled water	...	...	...	1,000 grams.
Potassium nitrate	...	...	...	1.0 "
Magnesium sulphide	...	...	...	0.5 "
Calcium sulphate	...	...	...	0.5 "
Calcium or potassium phosphate	...	...	...	0.5 "

To this solution a trace of some iron salts should be added—sulphate of iron would do.

The following are the proportions for another nutrient solution :—

Distilled water	...	...	...	1 pint.
Nitrate of potash	...	...	...	10 gr.
Chloride of sodium	...	...	...	5 "
Sulphate of magnesia	...	...	...	5 "
Sulphate of lime	...	...	...	5 "
Phosphate of lime	...	...	...	5 "
Sulphate of iron	...	...	...	1/2 "

The solution should be kept in the dark (wrap brown paper around the jar), and should be occasionally aerated during the experiment. The young plant would probably grow for a short time in the distilled water. If one of the essential constituents of plant food be omitted from the nutrient solution, although the young plant would grow better than in the distilled water, it would become in time, abnormally developed.

The following are the essential elements of plant food :—Carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus, potassium, calcium, magnesium, and iron. In the absence of even a single one of these elements, no normal development is possible. It is an interesting experiment to leave one of the essential elements out of the nutrient solution. Of course, it would be necessary to have the complete nutrient solution at hand so as to compare the results.

A soil may be rich in plant food, but unless it contains moisture to dissolve the food, the plant cannot develop. Moisture in the soil is an important consideration for the farmer; it is probably his *most* important consideration.

#### THE EXPERIMENTAL PLOTS.

Now that the planting season is at hand, some remarks on the field experiments will be useful.

Although a great variety of experiments is possible, it is not advisable to carry out too many at one time. If too many are carried out at once, complications may arise, and the children may become bewildered. Every experiment should have a definite aim, and should be carried out completely, a record being kept from start to finish. Suitable headings for the records are name of crop, variety, time of sowing, time of germinating, time of maturing, observations, and final results. Should an experiment not be completed, the fact should be recorded, the reasons for the non-completion being stated.

The principles and practice of agriculture can be illustrated without growing a very great number of crops, and the smaller the plot of crops grown the more difficult is it too *accurately* compute the yield per acre.

Although not insisted on, the size of the plot should be, wherever practicable, a quarter of an acre.

A branch of the field work that would be of value to the children and of benefit to the community is the endeavour to improve certain varieties of plants—wheat and potatoes, for example. In the case of potatoes, when they are being dug, the best plants should be put to one side, and the tubers from them planted the following season. If this procedure were repeated during the following seasons, an improved sample of the variety experimented with might be produced.

By choosing the best grains from the best heads in a crop of federation wheat and sowing them, that variety of wheat might be improved.

#### SEEDS.

The seeds for autumn planting will be forwarded shortly; those for spring planting will follow later on.

#### INTERTILLAGE.

One of the most important problems in connexion with farming is the conservation of moisture. It applies everywhere, but especially in districts in which the rainfall is low. Even in land where water can be applied by irrigation, there is still the necessity for conservation of moisture.

The first necessity is to have the soil in a suitable condition for the moisture to soak in. We must have the moisture before we can conserve it. The next necessity is to prevent excessive loss by capillarity and evaporation. A soil may be exceedingly rich in plant food, but without soil moisture to dissolve food, the land is barren. Moisture is of the first importance in dealing with land fertility. By means of surface tillage, capillary tubes are broken, thus preventing the loss of soil moisture. At the same time, weeds are destroyed and plant food is released.

The following table shows the results of experiments carried out at the New Hampshire Experiment Station :—

Plot.	Treatment Given.	Bushels of Shelled Corn
1	No culture; weeds allowed to grow	17
2	Mulch of 4 inches of old hay	56
3	Shallow cultivation—five times	80
4	Shallow cultivation—sixteen times	82
5	Deep cultivation—five times	74

These results tell their own story. The need of cultivation is recognized at a glance. It does not pay to let the weeds grow.

The 4 inches of hay, used as a mulch, did not secure the best yield; the water was held in the soil, but the soil was cold. The dry earth mulch is better; it is less expensive than the vegetable mulch, and it is effective. The moisture in the soil is preserved, air is allowed to enter, and the sun keeps the soil warm. There was no need to cultivate sixteen times; the extra yield did not pay for the extra work and expense.

In the deeply-cultivated plot, probably some of the roots were disturbed and injured. Maize is a shallow-rooted plant. The depth of the cultivation will depend on the root system of the plant. It will probably be found that shallow cultivation is generally the best. It kills the weeds, and makes a mulch.

Carry out similar experiments in the school plots; almost any crop will do to experiment with, e.g., potatoes, maize, mangel-worms, onions.

The best time to cultivate is after a rain, when the soil is slightly dried, so that when it is stirred it will not settle and connect with the capillary tubes below, thus defeating the very object set about to be secured.

#### EXPERIMENTS IN POTATO GROWING AT THE MARONG SCHOOL, BY MR. GEORGE ROBINSON.

In order to test the adaptability of our Northern District for profitable potato culture, we requested the Department to send us varieties likely to succeed in the dry warm parts of Victoria. We recognise that ours is not potato land, and that we must have favorable weather conditions during the growth of the plant. Unfortunately, the season was not favorable, as we had dry weather at a critical time of the plant's life.

The following four varieties were grown :—Up-to-date, Brown's River, Bismarck, and Beauty of Hebron. The first is a white-skinned variety, and is of a very robust habit. It was much more prolific than either Brown's River or Bismarck. The tubers were large, well-formed, and mealy; there were very few small tubers. The average yields per acre were :—Up-to-date, 6 tons 8 cwt.; Brown's River, 5 tons 13 cwt. 1 qr.; and Bismarck, 5 tons.

We planted the tubers of the 16th of September, and the plants appeared above the ground on the 10th of October. The soil is very sandy, and is deficient in humus, potash, and lime. We gave the plots a liberal coating of ashes to supply nitrogen and buried a quantity of decaying vegetable matter to enrich the soil in humus. In preparing the ground, we dug to a depth of 2 feet; it was then rolled and graded.

in maintaining attention. Every word they uttered was listened to with respect. It was quite evident that the teacher developed to the fullest extent the individuality of each pupil. For every one teacher who does this, there are fifty who do not. And yet it is the surest way to success, either as a character-former or as an effective teacher of any one subject of the programme. Every great teacher of the past has adopted such a course, and every teacher in Victoria who stands out above his fellow, intentionally or unintentionally does the same thing.

There were, of course, many other indications of attention to details. The outside of the school-house and the school grounds gave one the impression that they had been in existence fifty years, though the present teacher has had charge only three or four years. It would not be doing the teacher an injustice to say that he is not more industrious than the majority of State-school teachers. His success lies in the fact that he gets through a maximum of work with the minimum of effort. "The children run the school," as another inspector had previously remarked. I am never tired of telling teachers that they will be judged not so much by what they themselves do or say, as by what the children do or say. The last remark reminds me of a word of warning needed by some teachers who, in their anxiety to encourage their pupils to express themselves freely, and to make good use of their imaginative powers, are not very particular about the truth of their pupils' statements. A short time ago, I found it necessary to write in the Register of a school:—"A wildly improbable story of an exciting event that 'happened on the way to school' may be very interesting, and may show that oral composition is not neglected; but it is questionable whether the veracity of the pupil is not permanently impaired." The teacher may show her pleasure at such narration, but she must not be surprised if the same pupil, anxious to give pleasure to a cantankerous parent, goes home and makes out that the kindest of teachers is the most cruel of monsters. Whose fault is it if he does so? Why should he not make good use of his imaginative powers at home as well as at school? And yet, in an excellent school, the pupils ought to do a good deal of the talking. Nothing delights one so much as to hear children not talking for the sake of talking, not gabbling merely to show off their glibness, and not merely *hearing* questions but *asking* questions. It is only in an excellent school that I have noticed pupils freely asking questions. It is always a sign of good teaching, and of an excellent understanding between pupil and teacher.

This responsiveness on the part of the pupil is the best test of good teaching. Children who, under one teacher, are dull and listless are the next half-hour, under a different teacher, mentally alert. Their minds seem to catch the sparks that fly from the teacher's mind; and, when one notices this, there is little else to be wished for, as far as the teaching is concerned.

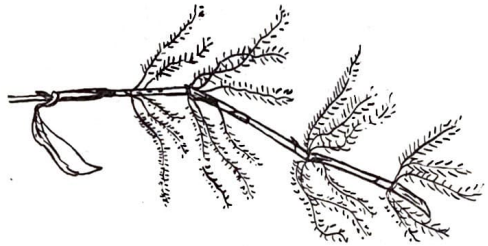
## AGRICULTURE.

By J. P. McLENNAN, *Supervisor of Agriculture.*

### NOTES AND EXPERIMENTS.

How the plant obtains the food from the soil :

It was shown by means of experiments 18 and 19 that the plant food must be dissolved before it can be taken out of the soil by the roots. After moistening and loosening the soil around a young plant, pull it up carefully by the root. Wash off the soil in a dish of water, and then examine the roots. They consist of whitish fibres, growing finer and whiter towards the tips. Under a magnifying glass, the delicate root-hairs will be seen. They are hollow tubes, closed at the ends, and have extremely thin walls. This can be seen only by means of a microscope. It is through these hairs, and through the delicate skin of the root fibres, that the plant sucks in the water in which the plant-food is dissolved. The root-fibres and root-hairs attach themselves to the fine particles of soil, and absorb the



Adapted from *Experiments with Plants*, by Osterhout (Macmillan and Co.).  
FIG. 1.—Cutting of *Tradescantia* grown in water, showing root-hairs.

moisture that is clinging to them as a film; the water which exists in the form of drops held in the angles of adjacent soil-particles is absorbed also.

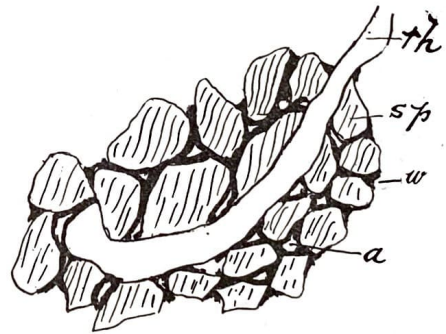


FIG. 2.—Diagram of a fairly dry soil, showing the relations of a root-hair (*r h*) to the surrounding soil particles (*s p*). The water (*w*) is held in the form of small drops between the angles of adjacent particles; the water also forms a thin film on the surface of each particle. The remaining space is filled with air (*a*). (Very highly magnified. Partly after Osterhout.)

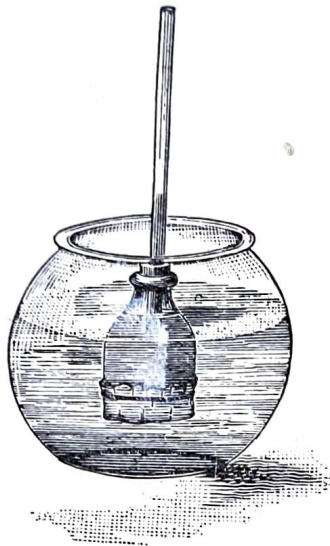
To show how the nutrient solution passes through the wall of the root hair and the delicate skin of the root:—

*Exp. 20.*—Take a small glass funnel and tie tightly over the mouth of it a piece of bladder, the membrane which lines the inside of an egg-shell, or a piece of very thin india-rubber. Pour in at the small end some strong syrup (sugar and water), brine (salt and water), or a solution of bluestone (sulphate of copper) and water, and dip the wide end into a basin of clean water (Fig. 3. Artificial root-hair). After a time, it will be seen that the liquid is rising in the tube of the funnel, and that part of the solution has come out through the membrane. In much the same way, the liquid inside the delicate rootlets and hairs being denser than the water outside draws that water in, and with it the food dissolved in it.

*Exp. 21.*—Another easy experiment shows this principle. Cut a carrot across and scoop a hole in the middle of the cut surface of one piece. Into this cavity put some dry crushed sugar. In a little while, the sugar will become a syrup by

absorbing moisture from the cells of the carrot, and the carrot will have visibly shrunk, and become wrinkled owing to the loss of moisture.

In order that the roots may be able to explore the soil freely and absorb water from it, it must be in a proper physical condition. It should be mellow, *i.e.*, of a loose,



From *Elementary Agriculture* (Whitcombe and Tombs).  
Fig. 3.—Artificial Root-hair.

friable texture. The physical condition of the soil is known as *tillth*. The proper *tillth* is obtained by means of *tillage*, when preparing the seed bed. In the garden, the soil is brought to a proper physical condition by using the spade, fork, hoe, and rake. The implements used in the field are the plough, harrows, cultivator, and roller.

The following notes have been supplied by Mr. H. J. Hauschildt, Science Master at the Warrnambool Agricultural High School:—

The space between the particles is called *pore space*. In considering pore space, let us assume that the particles are all spherical, all the same size, and packed so that the centres are above one another vertically. It will be evident that, in a given volume of soil, the pore space will be the same whether the particles are coarse or fine, so long as they are all of the same size.

Let us imagine each sphere to be placed in a cube having its side equal to the diameter of the sphere. Since the cubical contents of a sphere equals  $\frac{D^3}{6} \times 3.1416$ , the unoccupied space

(pore space) will be 47.64 per cent. of the cube, and that is so whether the sphere be large or small. If a smaller particle be now placed in the space between the spheres the space will be reduced, and it will be reduced still further if other smaller particles are placed between these. So the more even the soil particles are in size, the greater will be the pore space; in other words, the pore space depends on the variableness of the size of the particles.

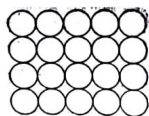


FIG. 4.—Equal-sized particles packed with their centres over one another vertically.

That the amount of pore space is the same whether the particles are small or large can be shown practically as well as mathematically.

*Exp. 22.*—Get a small, flat-sized vessel, and fill it with shot. Pour in water until the shot is just covered, and note how much water it takes.

Next, fill the same vessel with smaller shot, and pour as before. If the amounts of water are measured, they should be almost, if not quite, the same.

*Exp. 23.*—Now fill the vessel with a mixture of large and small shot, and see whether the quantity of water required to cover it will be more or less than was required in the cases.

Sand and clay have approximately the same pore space. If the soil particles are porous, the amount of pore space is largely increased. To prove this, fill the vessel used in the experiment with hollow beads, and see what quantity of water is required to cover them.

Assuming that 700 spherical particles of soil, each of diameter, weigh 1 gm., what is the approximate surface of 4 grms. of soil, if the particles in  $\frac{1}{4}$  of it have an average diameter of 1 mm.,  $\frac{1}{4}$  a. dia. of  $\frac{1}{10}$  mm.,  $\frac{1}{4}$  a. dia. of  $\frac{1}{100}$  mm., and the remainder a. dia. of  $\frac{1}{1000}$  mm.?

SOLUTION.

(a) 1 gram, the average diameter of the particles in equals 1 mm., will contain 700 particles.

The surface of a sphere =  $\frac{\text{Dia.}^2 \times 3.1416}{6}$ , or  $\text{Dia.}^2 \times .5236$   
 $\therefore 1 \times 1 \times .5236 \times 700 = 366.5200 \text{ sq. mm.}$

(b) 1 gram, the average diameter of the particles in equals  $\frac{1}{10}$  mm., will contain  $10^3 \times 700$ , or 700,000 particles.

$\therefore \frac{1}{10} \times \frac{1}{10} \times .5236 \times 700,000 = 3665.2000 \text{ sq. mm.}$

(c) 1 gram, the average diameter of the particles in equals  $\frac{1}{100}$  mm., will contain  $100^3 \times 700$ , or 700,000,000 particles.

$\therefore$  the surface is  $\frac{1}{100} \times \frac{1}{100} \times .5236 \times 700,000,000 = 36652.0000 \text{ sq. mm.}$

(d) 1 gram, the average diameter of the particles in equals  $\frac{1}{1000}$  mm., will contain  $1,000^3 \times 700$ , or 700,000,000,000 particles;

$\therefore$  the surface is  $\frac{1}{1000} \times \frac{1}{1000} \times .5236 \times 700,000,000,000 = 366520 \text{ sq. mm.}$

The total surface will be:—

(a)	...	...	366.52 sq. mm.
(b)	...	...	3665.20 "
(c)	...	...	36652.00 "
(d)	...	...	366520.00 "
			407203.72 sq. mm.

The surface varies inversely as the diameter.

The above solution is only approximately correct, as the diameter is taken, and it is assumed that the particles lie with their centres above one another vertically. This is not the case in nature, but the sum shows how the number of particles in a given surface increase as the size of the particles diminish.

\* That the number of particles in a gram varies inversely, as the diameter can be shown thus:—A sphere 1 cm. in dia. can be placed in a box whose side measures 1 cm., just filling it. Now place spheres  $\frac{1}{10}$  in dia. in the box; it will be evident that it will take 1,000 to fill it; 100 will fill the bottom, and 10 of these layers will be necessary to fill the box.

THE ROYAL AGRICULTURAL SOCIETY OF VICTORIA

Annual Exhibition—1st, 2nd, 3rd, 4th, 5th September

PRODUCE SECTION.

EXTRACTS FROM GENERAL REGULATIONS.

No exhibit will be allowed to enter in more than one class. General entries must be made in writing on forms supplied by the Society, and (including those by post) must be handed to the Secretary, at the office, Equitable Buildings, 100, Collins Street, Melbourne, on or before Saturday, the 25th July, at 12 o'clock noon. On payment of a double fee, entries will be received at the office after that hour till 12 noon on Saturday, 1st August, when all entries close.

Head teachers who are not competent to give the necessary instruction in such subjects as geometry, algebra, Latin, French, science, and drawing should advise their assistants and junior teachers, who have not completed their examinations, to join the Correspondence classes, and should, when forwarding applications, state which subjects they cannot efficiently teach.

Head teachers of schools in which there are junior teachers who are receiving postal tuition in extra subjects should continue to assist their junior teachers to as great an extent as they are able. It is expected that the corrections made, and the advice and directions given, will be of advantage not only to the junior teachers, but to the head teachers, and will enable them ultimately to give the necessary instruction without assistance. Head teachers should therefore keep in close touch with the correspondence work.

Provision has been made for two courses, (a) a short course for teachers who, having reached a fairly advanced stage in their studies, have reasonable expectation of passing the examination in December of this year, (b) a full course for such as do not intend to present themselves for examination before December, '09.

Subject to such conditions as may hereafter be specified, candidates for Second-class Certificate who have wholly or partially passed the Junior Public examination or some higher examination of the Melbourne University will not be required to take up such subjects (except drawing) as they have already passed in at the examinations referred to, the standard being deemed equivalent to that of the Second-class Certificate examination.

Applications for enrolment should be made in compliance with the instructions given on p. 179 of the June, 1908, number of this paper.

THE WORK-BOOK.

The method of ruling, &c., shown in the skeleton work-book issued with the last month's number of this paper, is suggestive merely. Other methods of keeping work-programmes may prove equally satisfactory.

AGRICULTURE.

NOTES AND EXPERIMENTS.

By J. P. McLennan, Supervisor of Agriculture.

The amount of plant food in the soil dissolved, and absorbed by the roots, is greater than would otherwise be the case because it is acted on by the acids that are exuded through the rootlets and root hairs.

Exp. 24.—Scatter some small seeds, such as mustard seeds, with damp sand, on a small slab of marble. After germination takes place notice the action of the roots on the marble. If marble is not procurable zinc will do.

Exp. 25.—Weigh a green plant (get one as succulent as possible); dry it, and weigh it again. Then burn what is left and weigh the ashes. Note and work out the percentage of loss in each case.

Moisture is necessary not only to dissolve the plant food but to distend the cell walls and give rigidity to the plant. When a succulent plant loses more water by evaporation than it can replace it becomes flaccid, or "wilts."

The following series of experiments is intended to show how excessive evaporation of soil moisture is prevented by regularly loosening the surface soil, or "interrillage" as it is termed, when a growing crop is treated:—

Exp. 26.—Procure two Bismarck lamp chimneys, or better, glass tubes about half-an-inch in diameter and a foot or eighteen inches long. Fill one with finely pulverized soil and the other about three-parts full with the same material—tightly packed in both cases. In the second tube complete the filling with similar soil not so finely pulverized and not so tightly packed as before. A piece of muslin should be tied over the bottom of both tubes. Stand both in a dish of water, and note the height to which the water rises, by capillarity, in both cases.

In the second case the continuity of the capillary passages is broken, thus preventing the water from reaching the surface.

Exp. 27.—Select three small plots in the school yard, say a square yard each, but not quite close to each other. At the end of winter or beginning of spring dig them to a depth of

about 6 inches. Keep the surface of two of the plots loose, working one (say) every fortnight, and the other after every fall of rain. Do not touch the third plot.

Towards the end of summer, especially after a spell of dry weather, test the plots for moisture. The difference might be noticed by simply digging a spit out and observing the appearance of the soil. A more accurate test can be made by weighing equal volumes from each plot. The tests could be made periodically until the autumn rains come, entering the results in the Agricultural Note Books.

Exp. 28.—Take 3 vessels (kerosene tins cut down will do); place equal quantities of soil in each, then add equal quantities of water; cover the soil in one with a vegetable mulch (grass or straw), and then weigh the three. Place them where little or no moisture can be absorbed. Frequently stir the surface of one of the two that are not covered with vegetable matter, do not touch the other. After some days weigh the three again, and note the results.

Both the earth mulch and the vegetable mulch break the continuity of the capillary vessels, or passages, and prevent the moisture reaching the surface and being lost by evaporation.

Exp. 29.—Next, ascertain the effect of the mulch on the yield of the crop. A simple method is to divide a planted plot into two equal parts. Frequently stir the surface soil between the rows in one part, neglect the other part. Note any differences between the plants in the two strips during growth, and accurately measure the yields when the crops reach maturity. The pupils should keep a record of this, as of all other experiments, in their Agricultural Note Books.

Exp. 30.—An extension of the last experiment was described in the April Gazette in an article dealing with "Interrillage."

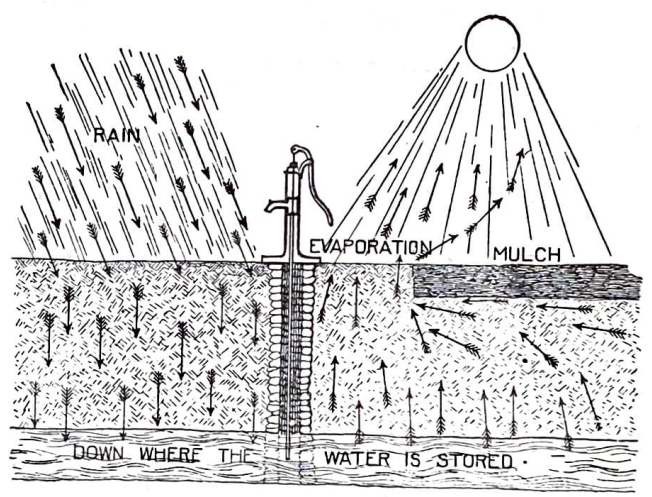


Fig. 1.

By gravity water goes into the soil, by capillarity it circulates through the soil and upwards, and unless prevented by a mulch, it goes out into the air by evaporation.—From *Soils*, by C. W. Burkett.

CIRCULATION OF WATER IN THE SOIL.

Exp. 31.—The rate of transpiration from a single leaf may be observed as follows: A large U-shaped glass tube is filled with water, and into one end of this tube is inserted a perforated cork bearing a small glass tube or capillary arm, bent at right angles. In the other end of the U-tube is fitted a cork through the perforation in which is inserted the leaf-stalk, with the stem reaching the water. (Fig. 2.) When this last cork is forced in, water will fill the capillary arm, and the recession of the water in this arm to supply that transpired shows the rate of transpiration. Wax or paraffin should be used to seal around the perforations. (From *The Principles of Agriculture*, by L. H. Bailey.)

Exp. 32.—The following is a simpler method of showing that water passes out through the leaves of growing plants:—Place some oilcloth, or other covering impervious to moisture, on the surface of the soil around a small leafy plant in the garden. Then place a bell jar, or a large glass fruit jar, which is

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quite dry inside, over the plant. After a time notice that drops of water are collecting on the inside surface of the glass.

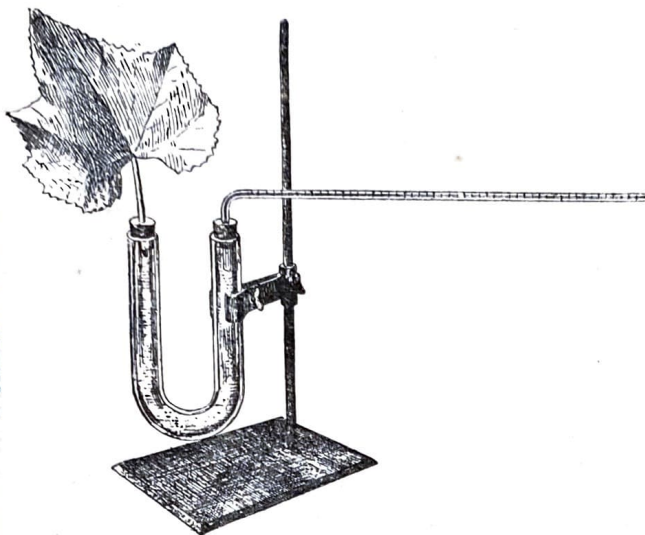


Fig. 2.

MEANS OF SHOWING TRANSPIRATION.

(Bailey's Principles of Agriculture.)

The soil moisture as it passes into the roots is not highly charged with plant food; so that in order to obtain sufficient nutritive matter from the soil, plants take up more water than they can retain, and the surplus water is exhaled through the leaves and other green parts of the plant. Usually this exhalation occurs in the form of vapour; but in some instances the water is discharged in a liquid state. Early in the morning, after a damp night, drops of water may be seen on the young leaves of some grasses and the garden nasturtium. They are often seen, too, on the aroids (arum lilies, or lily of the Nile).

SOME EXPERIMENTAL WORK.

The following is a description of some of the experimental work in agriculture done at the Mortlake State School when Mr. J. H. Refshange was in charge:—

1. (a) Placed pulverized local rock in well-drained pot. (b) Placed pulverized local rock with some decayed organic matter (rotted weeds), in another pot. Sowed bean in each. In (a) the plant died at the end of six weeks; in (b) plant attained maturity and produced ten well-filled pods.

Deduction.—(a) Local basaltic rock contains all plant foods except organic matter; (b) organic matter is necessary to soil in order that the soil organism (bacteria) may assist plant.

2. Placed equal weights of sand, and of clay mixed with sand, in two tins. Same weight of water was added to each; tins were exposed to air for a week. The mixed clay and sand was found to be the heavier.

Deduction.—Evaporation is greater from sand than from a mixture of sand and clay.

3. The above experiment was performed without the added water. The tins were exposed for one night, and were weighed in the morning. The mixture was heavier than the sand alone.

Deduction.—(a) Clay in soil assists its absorbing power; (b) soils absorb moisture from air.

4. Placed bean seeds with embryo up, on side, down; seeds with embryo down appeared first above the ground; seeds with embryo on side were next.

5. Experiments with potatoes. Sets cut; some were placed with "eyes" upward, others downward. In every case those with "eyes" upward appeared above surface of ground from 5 to 14 days before the others.

6. In March, planted potatoes at varying depths, 3 inches, 5 inches, 8 inches. Those planted at 8 inches came up first, then those at 3 inches; many of those at 5 inches failed altogether.

The potatoes at 8 inches received benefit of dampness conserved below. A slight shower moistened surface 10 days after planting and helped the 3 inches potatoes.

7. Placed a rubber tube over cut-off stem of balsam. Attached a glass tube; poured small quantity of water in tube. In 36 hours, sap had risen in tube  $\frac{3}{4}$  inch. Showed effect of root pressure.

8. Stripped off all leaves from hard-wood plant; in some instances death followed. Stripped off all leaves from soft-wood plant—none died.

Deduction.—Hard-wood plants depend almost entirely on leaves for breathing and digesting food; in soft-wood plants this work is also performed by the stems.

9. Cut four kerosene tins into halves, two transversely, two longitudinally; put same weight of soil in each; added to each same weight of water (stirring soil well). In Numbers 1 cut transversely and 2 cut longitudinally, the surface was stirred daily for 14 days; in the other tins the surface was not stirred. At end of time, Number 1 weighed the heaviest, No. 2 next.

Deduction.—Surface stirring breaks capillaries, and acts as a mulch, preventing evaporation. Deep cultivation tends to assist in conserving moisture.

10. Performed experiments with wheat, oats, barley, and mangolds. In every case, deep cultivation gave results, varying from  $1\frac{1}{2}$  to 4 times the weight of material over shallow cultivation.

11. Performed experiments with millets. Those in which the surface was stirred to a depth of 3 or 4 inches averaged 4 feet high, and those with no surface-stirring averaged  $2\frac{3}{4}$  feet.

12. Experiments with fertilizers. Crops all responded to the addition of phosphates, but showed no improvement with potash.

13. Cauliflowers and brocoli in July formed much larger heads when cincturing was performed than in the case of those where the operation was not performed. Cincturing was done at the time the flower was just forming.

AUSTRALIAN FLOWERING GUMS.

In the June number of this paper, attention was called to the desirability of planting Australian flowering gums on school grounds. The following note by Mr. Mackay, Conservator of Forests, gives some useful information concerning these trees:—

The red gum of Western Australia (*Eucalyptus calophylla*) and the scarlet flowering gum of the same State (*Eucalyptus ficifolia*) thrive best in Victoria southward of the Dividing Range, i.e., on the cool uplands of the Central District, and within the coastal area. They also grow fairly well on deep well-drained clayey or loamy soils northward of the Divide, which are sheltered from strong winds, but do not flourish in cold, damp situations. *Eucalyptus calophylla* also succeeds well in granitic alluvium, or even on hard granite drift. If set out on exposed sites, the young plants of both species should be sheltered by boughs stuck upright in the ground. The lemon-scented gum of Queensland (*Eucalyptus maculata*, var. *citriodora*) thrives well in deep, strong soils in the Central and Northern Districts. This tree is distinguished by its clear, milk-white stem, and long, glossy leaves, which give out a strong citron-like scent when crushed in the hand.

Perhaps the best native evergreen trees (*Eucalypti*) to group in small shrubberies or in school grounds for beauty of foliage or bloom would be the red gum of Western Australia, with its large, creamy white flowers and dark crown, the scarlet-flowering gum, the lemon-scented gum, the Gippsland mahogany (*Eucalyptus botryoides*), and the sugar gum (*Eucalyptus corynocalyx*). The mahogany, with its clear, myrtle-green foliage, and reddish-brown scaly bole, is one of the handsomest of trees, and, although its natural home is on the sandy clays of the coastal belt, which stretches from the Snowy River towards Cape Howe, it will accommodate itself to all deep porous soils in the cooler parts of Victoria. It may be pollarded or cut back when young, and then assumes the broad-crowned habit of the common European oak. To the above, three species of acacia may be added in the cooler districts, the Cootamundra wattle (*Acacia Baileyana*), the Bathurst wattle (*A. elata*), and the East Coast green wattle (*A. decurrens*).

On the drier tracts of the northern plain, the best trees to group for foliage and blossom are the sugar gum, the silky oak (*Grevillea robusta*), with long, orange-coloured combs, the pepper-tree (*Schinus molle*), the coolibah (*E. microtheca*), the belar or black oak (*Casuarina glauca*), the currijong (*Sterculia populifolia*), the crimson-flowering white ironbark (*E. leucocylon var. rosea*), and the dwarf variety of the golden wattle (*Acacia pycnantha*). The latter requires shelter, but will flourish on the poorest sandy loam, or even on ironstone ridges, and from the fourth year bears a wealth of deep golden blossom.

## ORIGINAL ARTICLE.

### PRACTICAL HINTS TO A BEGINNER.

By "Experienced."\*

**Assembly.**—This is one of the most important parts of the day's work, as a good beginning is a great factor in securing a good day's profitable employment of the children. Assemble every day punctually at 9.15. By your own example in being never later than 9 a.m., show the children what an important part punctuality plays. Greet the children with a cheery "Good morning." Take the breathing exercises and physical drill as laid down in the time-table; then march cheerfully into school.

For the nature-study chat, call upon one child to mention some local plant or insect observed, then rapidly get the remainder to tell you, in their own words, something connected with its life-story. Do not waste time in framing needlessly long and confounding questions, nor to obtain technical terms. With judicious handling, children learn to love these morning chats. (In my own school, before assembly, I often hear the children conducting a chat of their own in the playground.) Remember, this is a "conversational" lesson, and must be conducted as such. Do not adopt a loud, authoritative tone in questioning, or the child's interest at once ceases, and the chat becomes a bore.

**Reading.**—One great defect I noticed all through your school was that the children have adopted what I may term a laborious style of reading. It is noticeable throughout the classes. To remedy that, I would certainly follow the excellent advice in Cox and Macdonald's "School Method," pp. 134-135 for upper classes, and the earlier pages for the lower classes. In par. 22, p. 135, "silent" reading does not mean that the teacher is freed from the lesson and the children allowed to pursue their own sweet way. It is simply the preparation on the children's part, the teacher meanwhile devoting his attention to other classes. On his return to the reading class he should get the children to *tell*, in a conversational tone, the subject matter of the lesson. Impress upon the children that to *tell* you a story that some other person has told and has written so that many may know it. To read aloud a phrase or sentence and require the children to repeat it is a waste of valuable time. Check carefully all attempts at hesitancy. Teach the children "to let their eyes travel faster than their tongues." For a time, you will need to let the child look at a sentence, then say it while looking at you. In this way, you will impress upon him the above good rule, and also improve the tone of the reading. For the junior classes, you will find good help in Long's "Aim and Method of the Reading Lesson," from the beginning to p. 17. Combine this lesson with composition and writing in Class I. For a time, I would use such words as occur in the "Primer," skilfully worked in to form a story—always accompanied by a drawing of the object that forms the subject of the story. Whatever you do, do not allow the children to keep spelling, by themselves, the short words they use, till they form themselves into machine-like contrivances without aim or purpose.

**Recitation.**—In teaching this subject, first be sure that the subject matter is well understood. See that the children are

\* These notes were forwarded by a district inspector. They are a copy (with a few slight changes and additions) of what an experienced teacher, at the request of the inspector, supplied to a beginner.—[Ed. Ed. Gaz.]

well able to visualize the scenes described in the poem, get the author's thought. After this, the rest is easy, and the poem becomes stamped indelibly on the child's mind.

**Comprehension.**—If the reading lesson is taught on the laid down in the text book mentioned, comprehension is not laid down in the text book mentioned, comprehension is not Should new or difficult words or phrases appear, use the board. In the upper classes, many difficulties will be overcome by the children's self-effort, if access to a good dictionary is made easy.

**Writing.**—See Cox and Macdonald's "School Method," pp. 141-148. After that has been studied and grasped, I think the following hints useful in giving the writing lesson to the child above the First and Second, as they aid to produce correct formation of words. After correct posture has been attained, let the children read the copy. This, I think, is important, and good knowledge of the words to be written aid the child to complete each one without removing the pen. The copy is written on the blackboard by the teacher, and formation of loops, &c., carefully explained. The children then trace, with a dry pen, the words in the copy; after which, they attempt to write them. As the exercise progresses, the blackboard is essential in order to correct faults. The writing lesson should be so arranged that the poorest writers gain most advantage from the corrections. Uniformity of copy is most essential. Should irregular attendance cause a child to miss a copy, the copy should be gone over with the child in his own time, in order that he may join the rest at the general writing lesson.

**Grammar and Composition.**—It is well to begin this important subject in Class II. For that reason, I have, in the time-table forwarded to you, combined Classes III. and II. for one lesson per week in grammar. Should you skilfully treat the subject in elementary form, the Third Class act as helpers to the Second, while recapitulating their former lessons. Composition in these classes cannot be better treated than by obtaining children's stories, in their own words, following the subject-matter of the nature-study and mythological stories. I cannot need say that the careful correction of the work will prove immense value. (For the rest of the Third Class programme follow the "Southern Cross Grammar" (Whitcombe and Tombs), or "First Lessons in Grammar and Composition" for Class III.)—a more recent and good book published by the same firm.) For composition in the higher classes, I find it of great value to get the children to write, for a change, the life-story of some animal, insect, &c., as told by itself. This is a glory in, as they do in writing essays of short journal form (descriptive and containing sketches of the things described). For further treatment of this subject follow the "Southern Cross Series." Construction plays a prominent part in the teaching of analysis. When the children can "build up" clauses to form a story (the clauses named and the relations needed given), they have mastered a great difficulty, and are at once able to "break down" a given sentence. For example, Construct a story made up of a complex sentence beginning with a noun clause introduced by *where*, a relative clause attribute to the subject of the noun clause, principal adverbial clause of time modifying predicate of noun clause. Example: "Where is the book I gave you?" said the boy when he returned"; and so on, introducing difficulties. In practice, examples, the basis is formed in Class IV. by the teaching of inflexions. In this, there should be no difficulty in the application of the rules are taught with the rules.

**Spelling and Transcription.**—In dealing with this subject, the method advocated by Cox and Macdonald, p. 89, is followed in the infant classes, spelling seems to come naturally. In the higher classes, no better methods can be employed than to teach carefully the rules (see Cox and Macdonald, p. 164, and the February number, 1907, of the *Education Gazette*). In setting dictation exercises, I would warn you against setting too many. Have a little well done. In transcription exercises for the upper classes, I like the blackboard. Its frequent use by the teacher aids the passage from print to script. For further hints, see Cox and Macdonald, p. 158.

**Arithmetic.**—It would be useless for me to say anything about teaching infants this subject when such a lovely work as "Analysis of Numbers" is here, and so many aids are available. In the other classes, make sure that your aim is to *teach*, and see that the child thoroughly *learns* the subject in all steps in all work. Slipshod teaching of methods in the lower classes has been traced throughout the higher classes in the past. There are many good text-books available, choice of which