

APPLICATIONS OF GROWTH RETARDANTS

A Review by J. N. Hawtree

Though mainly concerned with cereals this review, which has been abbreviated, will be of interest to those concerned with grass where research into possible uses of these materials in greenkeeping has so far been limited.

Over the past few years, a number of chemical substances have been developed, which reduce or suppress the elongation of one or more internodes in plants. Such substances have been called growth retardants. One of these, known commercially as cycocel or CCC has received a considerable amount of attention recently in connection with increasing yield in cereal crops. Others such as B.995 and phosphon have been studied on a smaller scale, and may have some application in increasing yields in potatoes and root crops. There are several other uses to which growth retardants may be put, in agriculture and horticulture.

A number of basic properties are shown by all growth retardants, but there is considerable variation between the different types and their effects on different crops. This review will deal mainly with CCC, since this has been experimented with more than any other and appears to have the widest application.

In cereals the reduction of straw length by CCC has been demonstrated by many workers in several countries. In wheat, this reduction may be up to 50 per cent of the normal length. Tillering starts earlier in treated plants and is stronger: individual tillers grow almost as rapidly as the main shoot. There is an increase in shoot number at final harvest, but ear emergence may be delayed and grain size is often less than normal. The number of leaves per shoot is not altered, although they are on the whole broader and greener (Tolbert, 1960, Humphries et al 1965, Mayr & Presoly, 1963).

There may also be some anatomical effects in treated plants; for instance cell walls are normally thicker and the number of vascular bundles increases (Mayr & Presoly, 1963). In growth analysis experiments (Humphries et al,

1965), it was found that the leaf area index was decreased due to shortening of the sheath but the leaf area duration was increased due to delayed senescence. The net assimilation rate was generally decreased by the CCC treatment, particularly at high nitrogen levels, presumably due to denser growth and hence increased shading.

Tougher stems

The uses of CCC in the growing of wheat are firstly to reduce lodging and consequently the losses so caused; secondly to increase yield by allowing greater levels of nitrogen to be applied. In many trials, lodging has been entirely suppressed due to the reduced straw length and greater straw stiffness.

Reports of the effect on total dry matter yield when no lodging occurred in untreated plots have been inconclusive. Fajerson (1965) found that total yield was increased in some varieties, which decreased in others. Primost (1965) and Linsler and Kühn (1963) found that there was little change in short yield, but root yield was increased. Presumably the dry weight of individual tillers was decreased, but the increase in tillering possibly due to less shading, made up for this decrease giving a yield similar to or greater than untreated plants.

The second major use of CCC, as stated above is to enable greater levels of nitrogen to be applied, without the normal high incidence of lodging occurring under these conditions. Lecompt (1966) found that in winter wheat the response to CCC increased with the amount of nitrogen applied. However the majority of workers have found that increasing nitrogen levels reduced effectiveness of CCC (De Vos 1964, Caldicott & Lindley 1965, Linger & Kühn 1962).

(Continued on page 14)



may I help you?

Dear Bert,

I don't think my turf likes me any more. We got on fine all last summer and I was receiving congratulations from all over. I found it most encouraging and had great hopes for 1968.

Now I am not so sure. Though I work my turf pretty hard, it doesn't seem to be responding in its usual way to my kindness. What advice can you offer?

Yours,

"Worried Groundsman"

Dear Worried Groundsman,

Are you being kind enough? For example, did you reward your turf's hard work last summer by cosseting it in the autumn? You know you can't expect your relationship to be a happy one if it's all "take" and no "give".

My advice to you is to start thinking now about how you are going to treat your turf this coming Spring—because I'll bet it's been getting stick all winter.

There's an organisation devoted to helping such cases. Why not write to Berk now for a Catalogue of turf treatments? Their products are excellent and very reasonably priced. What's more Berk have a team of specialists who will advise you on the spot if needs be.

Yours, Bert.

	USE	APPLICATION & TIMING
Wormkilling 25% Chlordane Worm Killer (Liquid)	Kills worms, leatherjackets, ants and chafer grubs underground	Apply at a rate of 5 gallons per acre in warm showery weather when worms are most active
20% Chlordane Worm Killer (Granular)	No water or mixing required	Apply at rate of 80 lb. per acre in warm showery weather when worms are most active
Feeding Berk Spring/Summer Fine Turf Feed	Organic base for slow release of plant foods	Apply at 2 oz. per sq. yd. April to July
Berk Spring/Summer Outfield fertilizer	New low rate granular fertilizer	Apply at 3 cwt. per acre. April to July
Weed Control Berk Weedkiller (Standard) 2, 4-D	Controls broad-leaved weeds	Apply at the rate of 2-3 fl. ozs., in $\frac{1}{2}$ gallon of water per 100 sq. yds. in warm dry weather during Spring and early Summer
Berk Weedkiller (Super) 2, 4-D + CMPP	Controls resistant weed species	Apply at the rate of 2-4 fl. oz., in $\frac{1}{2}$ gallon of water per 100 sq. yds. in warm dry weather during Spring and early Summer
Berk Clover Killer CMPP	A specific to control clover but will also kill yarrow, pearlwort and chick-weed	Apply at the rate of 6-8 pints in 20-50 gallons of water per acre in warm dry weather during Spring and early Summer
Moss Control Berk Mercurised Turf Sand	A combined moss killer and grass stimulant	Water in during dry spells, not later than June at the rate of 4 ozs. per sq. yd. (10 cwts. per acre)
Moss Killer	Contains no grass stimulant	Apply at any time during the year. Application rate: 4 ozs. per sq. yd. (10 cwts. per acre)
Moss Eradicant	For use on Bowling Greens	Apply at any time during the year. Application rate: 4 ozs. per sq. yd. (10 cwts. per acre)
Fungi Control Berk Turf Fungicide	Gives rapid control of fungi such as Fusarium, Dollar Spot, Ophiobolus and Corticium	Apply whenever necessary at the rate of 1 oz. dispensed in 2-8 gallons of water or mixed with 14 lbs. of fine dry sand per 40 sq. yds.
Top Dressing Berk Fine Turf Top Dressing (contains Bedford Sand, Neals Kettering Loam & Fine Sedge Peat) parts by weight 3-2-1	Compounded with sterilised loam	Apply ready-mixed dressing in early Spring at 3 lbs. per sq. yd. (6 tons per acre)
Hose Tricoflex	Tricoflex is a high quality, durable and non-kinking hose	

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(Continued from page 11)

Influence of Water

It has been suggested above that water regime may be important in determining the effectiveness of CCC and this problem has been investigated specifically. CCC has apparently no effect on transpiration coefficient of total dry matter yield at various levels of water stress (El damaty, Kühn, Linser 1965). It has been found that grain yield may be increased under moisture stress, and that the higher the stress, the greater the increase. However it appears that straw length is reduced more at low moisture stress (Barbier & Mayr, 1966). Experiments at Rothamsted (unpublished) indicate that root growth may be stimulated and hence drought resistance on sandy soils might be increased.

As to the practical details of application, soil dressings and sprays are both effective; seed dressings however are poor, owing to the hygroscopic nature of CCC, which makes handling and sowing difficult. One application is normally enough. Primost (1965) found that if seedlings were sprayed they became diseased within a week (the symptoms were not described).

An aspect of CCC of more recent discovery is its effects on disease incidence in cereals. Jung & Sturm (1966) provided evidence that infections of *Septoria* and *Erysiphe graminis* were more pronounced in CCC treated plants. The incidence of damage due to *Cercospora* (eye spot) was however decreased.

In grass seed production CCC may have a use. Stoddert (1964) found that treatment with CCC reduced culm lengths, maximum effectiveness being obtained from those treatments given at earliest growing stages. The number of heads and head length per plant were increased by the treatment.

In U.S.A. experiments have shown that CCC usually retards growth in the grass *Cynodon dactylon*, but under low light intensities induces dense growth.

Apart from agriculture, there are a number of uses to which CCC might be put in horticulture. Flower initiation is usually earlier in treated plants: this effect has been exploited in the U.S.A. with early flowering azaleas (Cathey, 1964). Halevy and Wittwer (1966) reported that dipping cut flowers in CCC delayed senescence.

A list of references is available from the Editorial offices.

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HON. SECRETARY'S NOTES

REPORT ON WAGE SURVEY

On 16th March 1968 the Executive Committee reconsidered their previous recommendations and proposed that the previous figures quoted should be amended to the following:—

Head Greenkeeper £22 to £26 per week (plus accommodation).

First Assistant £17 to £19 per week.

Assistant £13 to £16 per week.

In the lowest scale every endeavour should be made to make additions for experience and special ability.

In the top scale the lower limit will represent comparative newness to a responsible post, or, for an experienced man, a wide range of additional benefits. The upper limit will often be exceeded for very responsible positions at busy clubs, but will otherwise represent a fully responsible position with few marginal benefits.

At present, competent First Assistants are in demand as Head Greenkeepers and the middle scale is therefore likely to be applicable only to a man potentially capable of full responsibility in some years' time.

In addition to the rates mentioned it is recommended that the Golf Club should operate a Pension Scheme which will ensure that a retired employee will enjoy an income, including his State pension, of not less than half his income at retirement.

This information is given because golf clubs frequently seek guidance from the Association as to the wages generally prevailing. The exact figures will remain

the subject of negotiation between the golf club and the greenkeeper in the light of local circumstances affecting the particular situation.

I have received a letter from Mr Tucker, on behalf of Lord David, thanking the members of the meeting for their letter and good wishes. My latest information is that he is feeling better but, as yet, does not feel up to writing. We all wish him a speedy recovery.

BARRUS MINI-MOW

A NEW rotary mower introduced in February was the "Mini-Mow" 14-inch Rotary Mower. Designed to cut both rough grass and lawns, the Mini-Mow has a single point height adjustment controlling all four wheels from ground level to 3 inches high.

Powered by a 3 h.p. Briggs and Stratton four stroke, the Mower has friction overload device to protect both blade and engine from excess damage. The cutting arc of the blades extends beyond the wheels, allowing the mower to cut right up to the edge of walls or borders.

1968 Lawnboy range

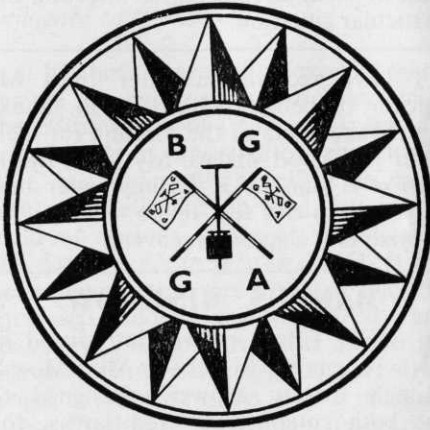
The basic range for 1968 remains mechanically unaltered from 1967, with the exception of the self-propelled 21-inch Automower.

The Automower has a redesigned positive belt drive, which is taken off the top of the flywheel. This provides better traction where the machine is being used on steep banks or difficult slopes. Another new feature on the '68 Automower is a snap action handle which controls drive to the wheels. The new control handle is a wrap around design which engages and disengages drive to the wheels with a minimum of effort.

Pioneer chain saws

Two new high speed models are included in Pioneer's 1968 range — the model 14-20 and 11-30. Both designs are available with automatic oiling and both are designed for hard professional cutting. Pioneer's "Inject-Aire" system is fitted on both models, allowing the fuel/air mixture to be adjusted for varying atmospheric conditions.

News



from the Sections **NORTHERN**

Chairman:
D. ROBERTS
(West Bowling G.C.)

By J. Parker
Hon. Secretary:
8 Goit Stock Terr., Harden,
Bingley, Yorks.

Subscriptions

MEMBERS ARE REMINDED THAT the new rates of subscriptions become due on the 1st May 1968 and are as follows:— Head Greenkeeper and Greenkeeper Professional, £1 12s. 6d.; 1st Assistant, £1 2s. 6d. and Assistants, 16s. 6d. Prompt payment would be much appreciated.

Spring Tournament

The closing date for the entries for the Annual Spring Tournament to be played over the course of the Knaresborough Golf Club on Tuesday, 7th May, is 30th April.

President's Competition

Mr W. Mountain, our President, has made arrangements for this tournament to take place on Monday, 24th June, and will be played at Howley Hall Golf Club, Batley.

Starting time will be from 3.30 p.m. Details will be sent out in due course.

February Meeting

This was held on Wednesday, 7th February in the clubhouse of the Horsforth Golf Club. Despite bad weather 35 members turned up but, unfortunately, owing to snow which blocked roads across the Pennines the speaker, Mr Howe of SISIS Ltd., was unable to make the journey.

A quickly reorganised discussion took place and a wide range of subjects ranging from Chlordane to etiquette of golfers gave members a chance to air their views — some in no uncertain manner. After a couple of hours the session was brought to an end by the Chairman, Mr D. Roberts. A most interesting evening was had by all.

March Lecture

Mr F. Robson of Blakesley Reid Ltd., lawnmower grinder manufacturers, was the speaker at our meeting held on Wednesday, 6th March, held as usual in the clubhouse of the Horsforth Golf Club. Thirty members attended, to hear of a subject "Mower Grinding" not dealt with previously. This we found most interesting and not such a simple operation as many members visualised. Many questions were asked and ably answered by the speaker. A vote of thanks was proposed by Mr W. Mountain and seconded by Mr D. Roberts.

EAST MIDLAND

Chairman:
J. BURNHAM

By S. Fretter
Hon. Secretary:
20 Woodcote Road,
Leicester, LE3 2WD.

Annual Spring Tournament

THE ANNUAL SPRING TOURNAMENT will be held at the Belton Park Golf Club, Grantham, on Wednesday, 8th May 1968 by kind permission of the captain and committee. First tee 12.45 p.m. Will those wishing to play and also to have a meal, please notify me by the 2nd May 1968.

Congratulations

I would like, on behalf of this Section, to congratulate D. Warrington, on his promotion to Head Greenkeeper at Birstall Golf Club, and wish him every success.

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New Member

We would like to welcome to this section of Greenkeepers, A. J. Whyman, 155 Leyton Crescent, Beeston, Notts, who is employed at Chilwell Golf Club.

SOUTHERN

Chairman:
J. K. GLASS
(Thorpe Hall)

F. W. Ford
Hon Secretary:
68 Salcombe Gardens
Mill Hill, N.W.7

March Quiz

THE EVER-POPULAR QUIZ, ONCE again, brought to a successful climax our winter programme and as our chairman remarked it was gratifying to see such a good gathering with such a lot of eager young faces among them. Not so young Bill McKean, who has not graced us with his presence for many years, was in a very lively mood and was on his feet with the question "Why is grass green?" almost before our Quiz Master could sit down. This started things off and a long discussion started on the destruction of moles and which weedkillers were most economical to use, etc. Another question asked was why weed seeds germinated on patches of ground previously sterilised to the depth of 6 inches or more by the heat of a bonfire.

A hearty vote of thanks to our Chairman-Quiz Master for the way in which he conducted the meeting and for the way in

which he kept his fellow countryman under control. Welcome back "Mac" and the best of luck with your "chock soil".

Thank you to Jack Stobbs for all the good work he has done for the Section as a committee member and we all wish him the best of luck in his new appointment in France.

Best wishes also to G. E. Steggalls who has moved from Cannons Brook, Harlow, to Brentwood Municipal Course, Essex, and to D. Campe who is now Head Greenkeeper at Rochford Hundred Golf Club, Essex.

George Barnfield

Dear Mr Ford,
The kind message of sympathy and generous tribute at the recent sad loss of my husband was very much appreciated.

It was a typical action of a fine organisation from which my husband derived great pleasure and help during his many years association. May you long continue to promote this good cause.

Yours sincerely,

KATHLEEN BARNFIELD.

St George's Hill

The Spring Tournament will be limited to 60 competitors, first come, first served! And as stated in the March issue of the *Journal* there will be a mini-bus laid on from the station to the club but only if there are



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sufficient members requiring it. So will you please let Mr Cooke know as soon as possible.

New Members

We welcome to the Section the following new members: S. F. Harrison and R. F. Baker.

A.G.M.

The Annual General Meeting will take place at the Stirling Castle, London Wall, Moorgate, at 6.30 p.m. on Wednesday, 5th June.

NORTH-WEST

By H. M. Walsh

Chairman:
F. HALSTEAD
(Bury Golf Club)

Hon. Secretary:
78 Hadfield Street,
Oldham, Lancs.

Lectures

THE LAST OF THIS WINTER'S series of talks was held on Monday, 11th March and took the form of an open debate. Once again there was a very good attendance, seventeen members turning up. Some very interesting questions were asked and answered. A very interesting evening was had by all. At this point I would like to say "Thank You" gentlemen for making this series as successful as last year.

Spring Tournament

All the details for this event were in the March issue of the *Journal*, the chief of them being the venue — The Royal Birkdale Golf Club, times from 8.30 a.m. The A.G.M. starts at 7.15 p.m. and the date 2nd May, Thursday. DO NOT forget the catering, please.

Subscriptions

Subscriptions are due on the 1st May. Please see the March *Journal* for the new rates.

Obituary

It is with regret that I have to inform members of the death of Mr S. Beavens of Crewe, an honorary member for a number of years. On behalf of all members I would like to express to Mrs Beaven and family our deepest sympathy in their sad bereavement.

WELSH

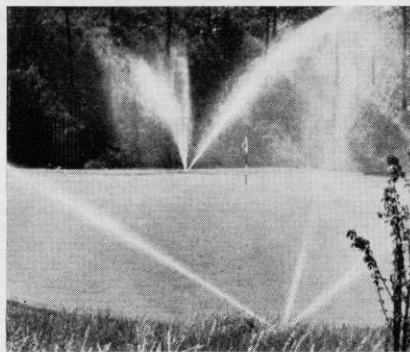
Chairman:
M. GEDDES
(Royal Porthcawl)

By S. A. Tucker
H/Sec. and Treasurer:
36 Chase Road,
Morriston,
Swansea, Glam.

Spring Meeting

YOUR SPRING MEETING IS BEING held by kind permission of the captain and committee of the Radyr Golf Club on the

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24th April. When you read these notes will you please write and let me know if you are coming to the meeting, by the 15th April, as this will give me only just enough time to make arrangements for the catering, etc. We shall be playing 9 holes before lunch and 18 holes after to make a 27-hole aggregate. There will also be a competition of 9 holes for the over 60s with two prizes, if there are enough entries.

I would like to report to our members that Dai Lord is in hospital. He has had an operation on a lung, but I am pleased to say that when I visited him this week he was looking better. If any of you wish to drop Dai a line I think it would be best if you send letters to D. G. Lord, 87 Old Road, Skewen, Nr. Neath, Glam., as I am hoping he will be out of hospital by the time you read these notes.

SHEFFIELD

Chairman:
G. HERRINGTON
(Lindrick)

By H. Gillespie
63 Langsett Avenue
Sheffield, 6

Lecture

IT WAS A BIG DISAPPOINTMENT that more members did not take advantage of the very interesting evening of 29th February when only 23 members greeted Mr Lock of Berk Chemicals Ltd., and his colleague, Mr Bailey. For someone to retain the interest of an audience for approximately three hours is proof in itself what an enjoyable and educational evening this was.

I would also like to take this opportunity of thanking Messrs S. Beaumont Ltd., who provided the refreshments.

A.G.M.

The Section Annual General Meeting will be held at the Brunswick Hotel on Thursday, 25th April. This is the time when you can make your suggestions and offer your criticisms.

Retirement

Mr D. Sadler, Head Greenkeeper at Lees Hall Golf Club, has retired after 43 years' service with that club, and club members gathered on Sunday, 3rd March, to show their appreciation to a very fine servant, and to make a presentation.

Denis has not enjoyed the best of health and we extend our good wishes for a long and happy retirement and a return to better health.

MIDLAND

Chairman:
G. HART
(Gay Hill)

By R. Goodwin
Hon. Secretary:
167 Birmingham Road
Lichfield, Staffs.

Spring Tournament

THE SPRING TOURNAMENT WILL be held at the Blackwell Golf Club, Nr.

Bromsgrove, by kind permission of the captain and committee, on Thursday, 25th April.

This event will be played over 27 holes, 9 holes in the morning, and commencing at 9.45 a.m.

Please let me have your entries by Thursday, 18th April, so that catering arrangements can be made.

New Member

We welcome to the Section, Trevor Morris, from the Whittington Barracks Golf Club.

NORTH-EAST

J. SIMPSON
(Ponteland G.C.)

By D. Earsman
Arcot Hall Cottage
Dudley
Newcastle on Tyne 3

Spring Competition

OUR SPRING COMPETITION WILL be held on Tuesday, 23rd April, at the Gosforth Golf Club, with the kind permission of their captain and committee. This will be an 18-hole Medal Event, commencing at 1 p.m.

New Member

We welcome J. R. Clark, of the Blyth Golf Club, to the Section.

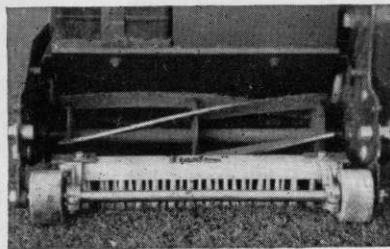
(Continued from page 20)

on buttered toast or cold piled in the centre of a green salad.

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Potted Crab

This is excellent for sandwiches and savouries.

1 medium-sized crab — boiled, $2\frac{1}{2}$ oz. butter, a sprinkling of anchovy essence, a little lemon juice, a few grains of cayenne pepper.

Take all the meat from the boiled crab, chop it up as fine as possible, mash it up very well and mix with it 2 oz. liquid butter, the anchovy essence, lemon juice and cayenne pepper.

Mix well and rub through a wire sieve into a jar. Stand the jar in a saucepan of gently boiling water and stir until the crab mixture is quite hot. Turn into a jar or three small jars. Melt the remainder of the butter and pour it over the paste, when the latter is cold.

(Keep in a cool place.)

Crab Cocktail

1 dessertspoonful Worcester sauce, salt, 1 medium-sized boiled crab, 2 tablespoonfuls tomato soup, 2 grapefruit.

Remove all the meat from the crab. Cut the grapefruit in halves across, remove any pips. Remove all skin and cut it into small pieces. Mix together crab and grapefruit, add the tomato soup, a sprinkling of salt and the Worcester sauce. Keep in the refrigerator or a very cool place until required. Serve in cocktail glasses.

To serve four people.

Croquettes (Crab)

1 large boiled crab, fat for frying, 1 breakfast cup of breadcrumbs, 2 oz. butter, a few grains cayenne pepper, salt, 1 teaspoonful tarragon vinegar, 1 egg, little flour, 1 teacupful breadcrumbs for coating.

Remove all the meat from the crab, chop it up very finely, mix the breadcrumbs with it, and the melted butter. Season with salt and pepper. Sprinkle over the tarragon vinegar and mix well.

Beat the egg and add half of it to bind the mixture, form into oval-shaped croquettes, flour them, dip them in the beaten egg and fry a golden brown in very hot fat, drain well, serve hot with vegetables, or cold with salad.

To serve four people.

Crab Special

1 wineglassful sherry, 3 or 4 mushrooms, 2 oz. butter, pepper, salt, 1 level tablespoonful flour, yolk of 1 egg, 2 tablespoonfuls cream, 1 large boiled crab.

Take all the meat from the crab, and be sure there are no scraps of shell. Add the sherry, cover and let stand for one hour. Peel the mushrooms and chop coarsely. Melt the butter and put in the mushrooms, cover and cook gently until quite tender — about 15 minutes. Season with salt and pepper, add the flour and stir until it thickens.

Put in the crab meat, stir in the cream and yolk of egg (well beaten) and continue stirring until well mixed — on no account let it boil. Serve very hot on toast.

To serve four people.

Crab au gratin

1 breakfast cup of breadcrumbs, 2 oz. butter, salt, pepper, 1 large boiled crab.

Pick the meat from the crab, season with salt and pepper and put into four well-buttered individual casserole dishes. Melt the remainder of the butter and add the breadcrumbs, mix together with a fork until they are well buttered. Cover the crab with the crumbs and bake until the crumbs are well browned.

To serve four people.

And of courses there is always . . .

Mock Crab

$\frac{1}{4}$ lb. cheese, $\frac{1}{2}$ teaspoonful made mustard, 1 teaspoonful vinegar, pepper, salt and drops of anchovy essence.

The cheese should not be dry; it should be rather on the soft side. Grate it into small shreds, mash with a wooden spoon whilst adding the seasonings. Stir in the vinegar gradually and the anchovy essence, serve hot

(Continued on page 19)