THE ECONOMIC IMPORTANCE OF RATOON STUNTING DISEASE

C. G. Hughes
Bureau of Sugar Experiment Stations, Brisbane, Queensland, Australia.

ABSTRACT

Satisfactory control measures for ratoon stunting disease are well established, but the disease is still causing losses in crop in practically every cane-growing country. The inherent seriousness of the disease and its lack of easily definable symptoms are responsible for this. General unthriftiness in growth and increased sensitivity to moisture stress caused by the disease, result in losses ranging from total to very little, depending on the seasonal conditions. There are no resistant varieties to help solve the problem.

Published estimates of commercial losses due to the disease are rare, so the reader is invited to draw conclusions as to his own losses from what has happened in Queensland, where control measures have been in operation for more than 2 decades. They have reduced direct losses to a minimum in some areas (although these still have to face up to the direct cost of control measures), but elsewhere an estimated loss of 10% of the crop meant that the year's receipts for the mill area were down $500,000 to $1,000,000. In a dry year a smaller mill area lost 30% of its crop due to the disease. The reader, making estimates for his own area will often be unpleasantly surprised.

INTRODUCTION

The continuing economic importance of ratoon stunting in many cane countries is due to the practical difficulties inherent in the control of the disease in commercial cane culture. Its ability to cause serious, even total, loss of crop makes it a serious disease by any standards. When its insidious nature and its extreme infectiousness are added, it becomes formidable indeed. These pose real problems in trying to convince farmers, plantation managers, and even extension officers, that a disease is present at all.

The practical technique of controlling ratoon stunting is well established; the rub comes, probably more with this disease than with any other in any food crop, when trying to get this through to the growers. A poor crop can be attributed to so many factors that, only too often, a farmer cannot be convinced that his crop is suffering from a disease. This applies almost as much to the grower in developed countries and the managers everywhere, as it does to the small grower still in, or just emerging from, a peasant economy.

The net result is that ratoon stunting disease is still a problem and is still causing losses in crop in every country where it has become established. Actual losses, or even estimated losses, are rarely published, or even hinted at, in the literature. The best approach, therefore, seems to be to discuss the problem in Queensland, where commercial control measures have been in operation since 1952. Readers can then consider this and form their own conclusions as to the losses in their respective countries. The deleterious effects of the disease on plant-breeding programmes will also be discussed.
POTENTIAL YIELD LOSSES

Resistant varieties are essential for the commercial control of disease in the vast majority of commercial crops. Sugarcane is no exception. One has only to think of the situation which would develop if genetical resistance to such diseases as downy mildew, gumming, leaf scald, smut and a score of others, were not available.

Ratoon stunting disease, however, is an exception in that, apparently, genes for high resistance in *Saccharum* are extremely rare. This means that there are no, or extremely few, commercially acceptable cane varieties which will not suffer losses when they become infected with the disease. The actual degree of loss depends partly on the tolerance of a particular variety to the disease and partly on the environment, notably the moisture available. The range of losses is thus from total to very little.

This sensitivity to the amount of soil moisture available is a feature of RSD and is not surprising when one realises that the disease causes a plugging of the vascular bundles. This would of itself make a variety more sensitive than normally to water stress. It is possible, of course, that toxic effects of the causal agent could add to the stress in the plant. Losses can become obvious at any time during the crop cycle.

Diseased planting material will usually give a slow and erratic germination. This means that sometimes "supplies" have to be planted to ensure an even stand. Either way, the farmer may have to cultivate more frequently than in a healthy crop, because of the longer period taken for the plants to form a canopy. At this stage death of stalks is not unknown should a dry spell occur.

Subsequent growth of the crop is slower than with healthy cane and the ultimate yield is decreased. This is due to the production of thinner and shorter stalks, rather than to a reduction in the total number of stalks, although, in a dry year, the number of stalks is reduced. The length of the stalks varies between wide limits. Somewhat unexpectedly, the sugar content is not reduced by the disease, although the tonnes of sugar per hectare, of course, show a drop.

The effects of the disease are markedly accentuated in the ratoon crop, hence the name given to it. The ratoons of diseased cane are slower to come away than those from healthy crops, particularly in dry weather, when the stubble may remain dormant for weeks or even months. The stool pieces do not show anything abnormal in either the rooting system or the underground stems and buds. They simply do not grow as soon or as well as expected. Usually a comparatively normal stand is eventually produced although, in a dry spring, many stools of some varieties die.

This slow start and loss of growing time is never made up and diseased crops continue to be backward compared with healthy crops of the same age. Several instances of this are well shown in the chapter on the disease by Steindl in *Sugar-Cane Diseases of the World*, Vol I. Should the wet season fail, many diseased fields remain stagnating for so long that, with no crop in sight, the farmer ploughs out the stubble in preparation for a new planting. The actual cost of this curtailment of the crop cycle is difficult to estimate, but it must be considered in estimating the cost of the disease to a district.

Diseased ratoon stools contain fewer stalks than normal and they are shorter and thinner, with light tops and a general unthrifty appearance. Such crops become infested with weeds, which results in poor burns and consequent
penalties at the mill for excess extraneous matter.

It has been found, in Queensland, from a long series of trials involving some 682 varieties, that the vast majority of commercial canes can suffer severe to very severe losses from ratoon stunting. The trials incorporated replicate plots of adjacent healthy and diseased cane. In most of the trials the diseased cane came from setts inoculated with infective juice but, recently, setts from diseased cane have been used. Effects were even more pronounced than in the earlier trials. Losses were assessed on visual estimates of tonnages, which were found to have a very high positive correlation with actual weights. An analysis of a typical trial showed that approximately 60% of the differences between healthy and diseased cane in a first ratoon crop could be attributed to genetic factors, and the most tolerant variety suffered a 30% loss in yield.

It is clear beyond doubt that, without effective control, ratoon stunting disease has the ability to cause enormous losses in practically all canes reaching commercial cultivation.

**ACTUAL LOSSES**

The cost to a cane industry of ratoon stunting is made up of what may be considered indirect and direct losses. The indirect losses, which are virtually impossible to estimate, stem from such items as:

1) poor germination and ratooning,
2) extra cultivations in both plant and ratoon crops,
3) increased harvest costs due to low tonnages of cane and the presence of weeds, and,
4) the curtailment of planned crop cycles.

Direct losses of money are due to:

1) yield loss in both plant and ratoon crops,
2) loss of ratoons, which may have to be ploughed out prematurely, and
3) cost of control campaigns.

The disease is well under control in many areas of Queensland. Losses of crop there are at a minimum, but still several cents per ton of cane are spent on control campaigns. These involve wages, hot-water tanks and associated equipment, as well as the cartage costs of cane to be treated at centrally located plants.

In other areas, for various reasons, control of the disease has not been as effective. This applies particularly to areas, largely in northern Queensland, where rainfall is usually adequate and irrigation is not practised. In such areas, estimates of losses based on performance of healthy and diseased cane on farms have given a figure of about 10% loss over the entire crop. This represents 50 000-100 000 tonnes of cane, which, at approximately $10 per tonne, is $500 000 to $1 000 000. This is serious in any language!

In one small mill area in southern Queensland, which is subject to drought and has little irrigation at present, losses in one year due to the disease were estimated at 30% of the crop.

**EFFECTS ON THE BREEDING PROGRAMME**

There is no record of the transmission of ratoon stunting through the true seed of sugarcane. Seedlings are therefore regarded as free from the disease.
However, once they enter the selection programme they become liable to in-
fection, and the further they are advanced the more likely are they to become
diseased. Special precautions with regard to sterilisation of cutting implements
and the use of disease-free material in the reference plots and any border rows
in the trials, are thus necessary if the seedlings are to remain healthy. Such
exacting measures are beyond the capacity of some experiment stations. The
plan followed is only too often to allow uncontrolled exposure to infection.
This distorts the selection programme in that varieties may be selected merely
because, having escaped infection, they perform better than their running
mates which have become diseased. This effect can also be seen when the
stocks of a seedling are only partly infected. Complete and uniform infection
through all the seedlings results in selection primarily for tolerance to ratoon
stunting, with other factors relegated to minor roles. Many sensitive but other-
wise highly desirable varieties could thus be lost.

Serious effect of the disease on the cane breeder’s output can occur at
any time from the first clonal propagation from the original seedling to the
multiplication stage before general commercial acceptance. In any case, it
results in a waste of time and effort.

Other diseases, mosaic for instance, could have the same deleterious effect
but, since their symptoms are not usually so obscure, the effect does not match
that of ratoon stunting.

It is regrettable that, even today, more than 20 years after ratoon stunting
received world-wide publicity, workers at many research centres are not fully
aware of the stunting effects of the disease on their search for new canes.

CONCLUSION

I have not attempted to produce a money estimate of the losses due to
ratoon stunting throughout the sugarcane world. As I said at the beginning,
the losses are still there in many countries; it is up to individuals to make their
own estimates for their own countries. They will often be unpleasantly surprised.

LA IMPORTANCIA ECONÓMICA DE LA ENFERMEDAD DEL
ENANISMO DEL RETOÑO

C. G. Hughes

RESUMEN

Los métodos satisfactorios de control de la enfermedad del enanismo
del retoño están bien establecidos, pero esta enfermedad todavía causa
pérdidas en esta cosecha en prácticamente todos los países que cultivan
la caña de azúcar. La seriedad inherente de esta enfermedad y la falta de
los síntomas definidos que nos faciliten un diagnóstico son responsables
para eso. Generalmente, un crecimiento frugal y el aumento en sensibilidad
da la humedad causada por la enfermedad resultan en pérdidas que varían
desde una pérdida total a muy poco, dependiendo de las condiciones ambien-
tales o de la época. Todavía no existen variedades resistentes para ayudar
da resolver este problema.
Los estimados como pérdidas comerciales que se han publicado debido a esta enfermedad son raros, por eso, el lector puede hacer sus propias conclusiones de sus pérdidas basándose en los acontecimientos de Queensland, donde métodos de control han estado operando por más de 20 años. Ellos han reducido las pérdidas a un mínimo en algunas áreas (aunque esto todavía tiene que determinarse y compararse con el costo directo de las medidas de control), pero en otras partes se ha estimado una pérdida de 10% de la cosecha que significa que el molino o central azucarera dejó de recibir de $500 000 a $1 000 000. En una central o molino más pequeño en un año seco se perdió 30% de su cosecha debido a la enfermedad. El lector al hacer estimados para su área puede encontrarse frecuentemente disgustado.