SUGAR CANE

VOL. 26 No. 1 December 2009

PUBLISHED BY THE SUGAR INDUSTRY RESEARCH INSTITUTE, SUGAR INDUSTRY AUTHORITY, JAMAICA

NEW SMUT & RUST OUTBREAK

by T Falloon, M Bennett-Easy, U Green & D Wright

Jamaica's sugar cane industry is undergoing its second smut & rust disease outbreak. The first took place in the 1970s. By early 1980s that outbreak was brought under control by replacing susceptible varieties with resistant substitutes. Though there have been subsequent outbreaks of leaf scald, yellow spot and yellow leaf syndrome, these have had relatively minor impact on the industry. Also, in the last decade there was confirmation of the presence of ratoon stunting disease. However, the issue of immediate concern is the fresh outbreak of smut and rust on our hands.

Fortunately, though of major concern, the current outbreak is likely to be of lesser consequence than that of the 1970s because area under susceptible varieties is just some 10% of total compared with 50% in the 1970s when HJ5741 and B4362, the major varieties of the day, went down with the diseases. Furthermore, the 1970s outbreak hit when the industry was producing some 3.5 million tonnes cane per annum. Today, the scale of production has dropped to under 2 million tonnes so in effect affected area under attack is just about 5% of 1970s cane area.

This time, thankfully, the major varieties – BJ7504, BJ7465 and BJ7015 – are only mildly affected. The blow has been primarily to promising new varieties, such as J9501, BJ8532 and BJ8534 which were being rapidly propagated but must now be removed because of smut susceptibility. With the orange rust, the varieties known to be affected are mainly BJ9186, BJ7230 and BJ82156. Fortunately these are largely confined to one zone, the St Thomas-Ye-Vale area of St Catherine dominated by Worthy Park.

Continued on page 6

Orange rust infected cane field, Worthy Park

COST-EFFECTIVE WEED MANAGEMENT IN SUGARCANE

By M. Edmond Lewis

There is the common belief among farmers that herbicides (weed killers) are the only way to manage weeds in cane fields, but nothing could be further from the truth. There is also the common belief that newer herbicides do a better job of controlling weeds although most 'new' herbicide products are not really new. Instead, they are repackaged old active ingredients.

The preferred, and recommended weed management option is an integration of cultural, mechanical, manual and chemical methods, each being implemented as the current situation warrants. The questions which might then be asked are: which method will be appropriate for each condition, and how best to implement these methods?

Manual

Manual weed management involves the removal of weeds from fields by pulling them out with bare hands, or with the aid of tools such as rake, cutlass, hoe or other hand-held implement. With the aging population of farm workers, and the large numbers required for manual weeding, it is often not cost effective, especially on larger farms. It is more applicable in small fields, or where weed distribution is localised, or where land is stony or too sloping to facilitate machinery. A major advantage with hand weeding is the efficiency with which it removes established weeds within cane rows without damage to the cane. The major drawback is how it ignores newly germinated weeds. Weed regrowth therefore tends to be very rapid following hand weeding. Manual methods of weed management have therefore largely outlived their usefulness, hence other methods must be considered.

Mechanical

Mechanical methods are an improvement on the manual weed control. Both seek to remove weeds with the use of an implement after they appear and are competing with the cane. Mechanical means include harrowing, ploughing, rotavating, and tining, and are more effective in drier areas, and where soil is fairly light. They allow for treating large areas in a relatively short time with minimal demand for labour. Major disadvantages are the associated cost of the tractor operation and limitations posed by steeper slopes. Operations may also be delayed, with disastrous results, by rain. The length of protection from weed regrowth is also very short.

Cultural

Cultural methods use the characteristics of the crop and the prevailing environment to the benefit of the cane, and to the detriment of weeds. It begins with good land preparation, row spacing, soil moisture and fertility, followed by the use of good seed material which will germinate and establish rapidly. A good population of healthy canes in a field will shade out most weeds within a few weeks, and secure for the cane the available resources of sunlight, space, moisture, and nutrients.

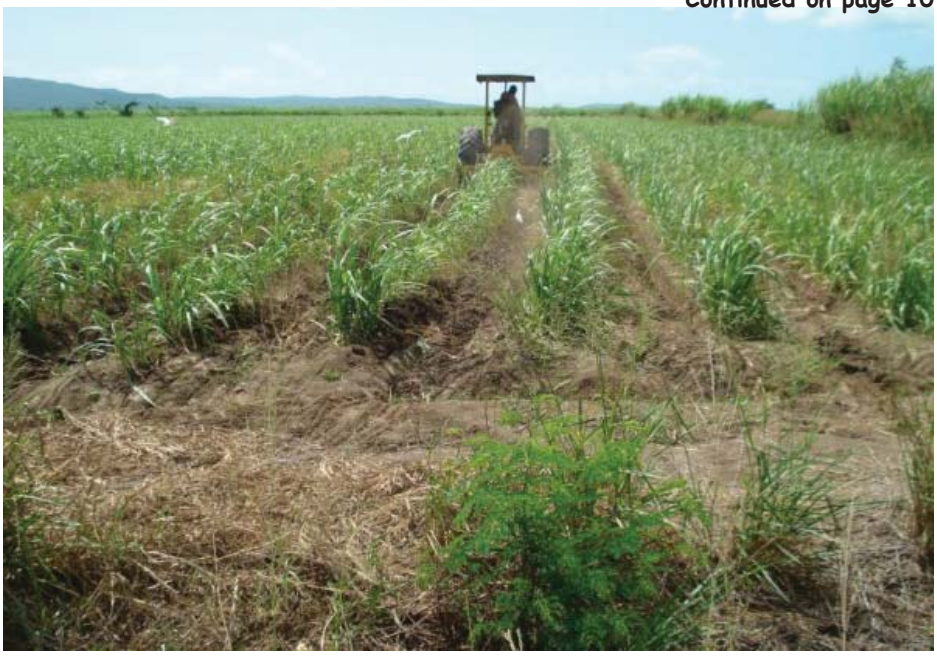
Cultural practices are a major aspect of cost effective weed management. When done on a timely basis, these practices form the basis for herbicides to work in an effective manner.

Chemical

Chemical management of weeds is the use of herbicides to kill, suppress, or otherwise reduce the competition between cane and weeds. Because of flexibility, ease of use and efficiency, this method is preferred but quite often overused. Granted, there is a herbicide suitable for each type of weed - broadleaf, sedge or grass; each texture of soil - heavy, medium or light; various stages of weed growth - before, during and after establishment; and for each environment - wet or dry.

When chemical weed management is considered, there are many ways to implement it. The preferred, and most cost

Continued on page 10



Mechanical implement can manage weeds efficiently under suitable conditions

Good weed suppression from effective pre emergent herbicides

Good stalk population and weed control with integrated management

Damage may occur when herbicides are applied too late

New Smut & Rust Outbreak contd...

Disease Strains

Diseases are never static. From time to time new diseases cross borders and enter new environments and old diseases mutate to produce new strains. Varieties that are resistant to an existing mix of diseases may prove susceptible once that mix is changed. Though we were essentially freed of smut and rust for over two decades, we now seem to have a new smut strain that forces removal of the varieties named and will eliminate many more in the ongoing variety selection process.

This emergence of new diseases is not unique to Jamaica. Orange rust was present in Australia for over 100 years and caused little concern until 2000 when a new strain caused severe losses in that industry. Orange rust has now found its way into the Americas where it was first detected in Florida in 2007 and has since been reported from Guatemala, Costa Rica, Nicaragua, Cuba and Jamaica.

In Louisiana, USA, variety LCP85 384, released in 1993, soon became the rave yielding some 30% more than other varieties being grown. By 2004 it was propagated to occupy all of 91% of that industry. When first released it was rated resistant to the brown rust. Yet, in 2000 it was struck by a severe outbreak of brown rust causing an estimated 20% yield loss. The brown rust had apparently developed a new strain to overcome the resistance.

Orange Rust Distribution

Orange rust was first detected in Jamaica in August 2008 on samples collected at Worthy Park. Since the formal identification, the disease has remained largely within the Worthy Park/Bog Walk area. Symptoms have been seen on the occasional plots of BJ9186 scattered across the industry and in fields of BJ82156 at various other locations. However, up to the end of 2009, most severe attacks were still to be found at Worthy Park.

The orange rust pathogen, which is spread by wind, would by now be all over the country. It is therefore not surprising that the disease is often seen in SIRI's variety trials, located at various points across the industry. A number of clones showing symptoms have had to be removed from these trials.

It is believed that high humidity in valley areas such as Worthy Park provides ideal conditions for the disease to flourish. Coupled to that is the fact that Worthy Park has the largest area of fields under susceptible varieties.

Smut Distribution

In the case of smut, the disease affects all areas with the greatest incidence being in the irrigated areas of lower St Catherine and lower Clarendon where susceptible varieties J9501, BJ8532 and BJ8534 have gained widest establishment.

SUGAR CANE SMUT

Sugar cane smut, caused by the fungus *Ustilago scitaminea*, produces the familiar curved, pencil thick "whip" which emerges from the tip of the stalk. Whips may be a few inches to several feet long and are typically seen in 2-7 month old cane. Occasionally whips may be produced from buds along the cane stalk. A whip comprises a central core bearing millions of spores initially covered by a thin film which peels off releasing the spores to the wind. In cases of extreme infection, stalks within a stool may be reduced to grassy shoots each terminating in a whip.

Smut is well known to mutate and hybridise in nature. At least five distinct strains are known to exist globally. Hawaii, for instance, acknowledges the presence of a Race A and a Race B in that industry from during the 1980s.

In Jamaica, varieties formerly rated moderately resistant such as J9501, BJ8532 and BJ8534 have suddenly become smut susceptible and the level of smut in evidence has risen intensely in fields across the industry. This may well be circumstantial evidence of the presence of a new smut strain. The disease affects all areas of the industry with greatest intensity being in the southern irrigated plains where most of the susceptible varieties are to be found.

Smut Impact

In a study conducted at Worthy Park, smut prone varieties BJ8532 and J9501 were shown to lose approximately 47% of cane yield (tc/ha) over the two year period, 2007 to 2009. Highest yield loss occurred in a field BJ8532 which fell from 89.89 to 46.90 tc/ha in a single year.

SUGAR CANE RUST

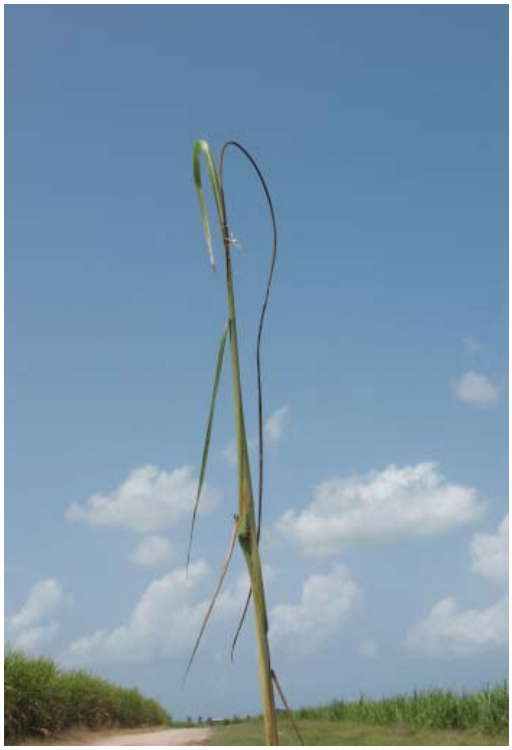
The rust (*Puccinia melanocephala*) that attacked in the 1970s is now referred to as the brown rust to distinguish it from the orange (coloured) rust, *Puccinia kuenhii*, identified in 2008. Both species cause lesions on the cane leaf surface. Millions of spores, invisible to the na-

Orange rust leaf, Worthy Park

ked eye, are released to the atmosphere from pustules clustered mainly on the under surface of the leaves. Rust reduces the healthy leaf area causing leaves to die prematurely, thus reducing plant growth and cane yield.

Rust Impact

Between 2008 and 2009 when resistant varieties at Worthy Park maintained relatively steady yields of 77.87 and 76.25 tc/ha, respectively, orange rust was estimated to cause on average over 17% drop in yield of BJ9186 and BJ7230. Highest drop in a single field was 61%, (from 96.10 to 37.38 tc/ha).



Smut whip

RECOMMENDATIONS

The new smut and rust outbreaks are therefore capable of causing substantial losses to the industry and should not be taken lightly. It is not considered practical to control either disease by chemical treatment. The recommended approach is to replace susceptible varieties with ones that are resistant.

Accordingly, there should be no further planting of J9501, BJ8532, BJ8534, BJ7230, BJ9186 and BJ82156. Growers should give priority to removing these varieties from cultivation after harvest, starting with the worst affected fields. For smut infected fields, plough the land thoroughly and if possible wet to trigger spore germination. After soil has dried out sufficiently, resume and complete land preparation and planting.

Crop Rotation: Growers might also consider planting a crop of red peas, pumpkins, pepper, Sea Island cotton or other crop which does well in the particular area and returning to cane production after a few months when the rotation crop is reaped. This will more thoroughly rid the soil of the disease pathogens that would attack the new cane plants while providing short term earnings and boosting soil productivity.

Replanting: Use only resistant varieties recommended by SIRI as replacements. Remember, SIRI is empowered by the Sugar Industry Authority (SIA) to issue a list of recommended varieties for any given time or circumstance. As custodians of the Industry's health, SIRI asks every grower to assist in keeping sugar cane fields as disease free as possible. No SIA loans will be approved for growers planting varieties which are not recommended.

EMERGENCY CERTIFIED SEED CANE PROGRAMME

To partly address an anticipated shortage of seed cane of recommended varieties, in August, 2009, SIRI launched an Emergency Certified Seed Cane programme designed to establish some 10 ha of good quality seed cane in each of 5 ecological areas. These nurseries were planted to newly released, recommended varieties such as BJ8783, BT80311, BJ82105 and BJ8841 which should be at

Continued on page 10

Brown Rust on B4362

Smut infected stool

VARIETY RELEASE

by M Bennett-Easy

Recent outbreaks of smut and orange rust place additional pressure on the variety programme. New varieties which were about to be released at this time such as BJ8783, BT80311 and CR892023 have had to be withheld pending further disease evaluation. Meanwhile, BJ82105, yet another variety from the productive BJ82 series, is being propagated as a first step towards filling the gap created by the loss of BJ8532, BJ8534, J9501 etc to the industry. So far, this variety has shown little sign of disease susceptibility. Within the year sufficient data should be obtained on the newer varieties to determine whether they may be safely distributed to growers.

BJ82105

Parentage: B69632 Polycross

BJ82105 is particularly favoured at this time for its apparent resistance to both smut and rust diseases as well as its satisfactory juice quality and cane yield. The main distinguishing features of BJ82105 are its erect reddish purple internode.

BOTANICAL DESCRIPTION

Stalk: Erect, of medium thickness with little tendency to lodge. Internodes are of medium length, with light to moderate wax coating. The stalk configuration is cylindrical. Old internodes maintain a reddish purple flush overlaid with black spots. Internode cracks are absent. Root band is of medium width and reddish purple in colour on older joints but creamy on young joints, while root initials are tinged purple. The root primordia are not very conspicuous. Growth ring is well defined, reddish purple on older joints.

Bud: Inserted above leaf scar and slightly touching growth ring. It is distinctly ovate in shape, reddish in colour developing a purple tinge on older internodes. Bud wings are not well developed.

Leaf: Blade of medium length, typically dark green, broad in the middle and tapered toward the tip. Leaf sheath is greyish purple with medium wax covering. Sheath hair is absent.

Arrowing: BJ82105 does not normally arrow in Jamaica.

AGRICULTURAL FEATURES

Germination: Good, but planting material and conditions must be good.

Tillering: Quite rapid and profuse, thereby giving excellent ground cover. Late tillers are scarce, except in lodged fields.

Growth Pattern: Elongation quite rapid, providing good early cover.

Habit: Generally very erect to maturity

Trashing: Self-trashing

Ratooning: Reliable under good conditions

Quality: Above average juice quality throughout the harvesting season.

Adaptability: BJ82105 appears to be widely adapted. It is suited for clay loam soils in rain-fed and irrigation areas.

Mechanical Harvesting: Suitable for mechanical harvesting.

Disease Reactions: It is resistant to smut and has so far shown no susceptibility to the new orange rust or the old brown rust.

General: The variety has achieved importance in the Appleton area where it has been extensively grown for a number of years. Favourable experimental yields were recorded in the Bernard Lodge area ✤

New Smut & Rust Outbreak

contd...

a suitable growth stage to be the core of a secondary nursery programme in the spring of 2010. These varieties, except for BJ82105 which is being formally released, will be further observed for orange rust resistance before being included in the general replanting programme. Major estates were also encouraged to establish seed cane nurseries to meet the next crop's replanting needs. SIRI continues to work with estates and farms in identifying and inspecting seed sources and ensuring purity of stands.

While SIRI places emphasis on the establishment of nurseries of the newer varieties, growers should also establish nurseries of the current resistant commercial varieties – BJ7504, BJ7465, BJ7938, BJ82119, BJ78100, BJ7314 etc. It is extremely important that nurseries be properly rogued to ensure pure stands as too often in commercial planting, smut susceptible varieties such as B49119, BJ7013, BJ8226 etc are inadvertently mixed up with the main variety. No variety of cane is immune to smut. If bombarded with enough of the disease, any variety will eventually succumb. Planting from pure stand nurseries is the best means of moving away from this problem.

For future Certified Seed Cane Nurseries, SIRI must be satisfied that nurseries are of pure stand of recommended varieties and that appropriate agronomic practices are applied. At least 50% of seed cane so produced must be made available for sale to other growers; the rest may be used in the farmer's own replanting programme.

CONCLUSION

While new strains of smut and rust present new challenges for the industry, the task is not as formidable as in the 1970s as the area affected is today much smaller and our major varieties are this time relatively unaffected. Nonetheless, this makes the task of producing new varieties even more challenging as additional large numbers of potential new varieties will be eliminated during the variety selection process. The problem is best addressed by a well managed nursery programme to speed replacement of susceptible varieties. SIRI is working assiduously to propel this programme ✤

Cost-effective Weed Management in Sugarcane

contd...

effective method is the pre-emergent technique. Following the good cultural practices outlined earlier, the appropriate herbicide may then be applied to the bare soil before weed seeds start to germinate. Small and medium scale farms should strive to apply pre-emergent herbicides to all plant and ratoon fields. Large farms and estates should treat all plant fields with pre-emergent herbicides and at least 50% of ratoon fields, initially. The aim thereafter is to gradually increase the hectares treated at pre-emergence until the total farm can be covered. Pre-emergent management of weeds aims to reduce the reservoir of weed seeds in the soil, and to prevent weeds from competing with canes in the early stages when canes are less able to ward off the ill-effects of weed competition. From the current list of herbicides, only those containing paraquat and glyphosate are not recommended for pre-emergent usage.

The second and slightly less efficient method of chemical application is at early post-emergence. The herbicides must be applied to weeds as early as each species can be recognised by its true leaves. Management of weeds at this stage recognises that competition with cane has begun, and there is potential for yield reduction. Hence, immediate complete elimination of competition from weeds is essential to allow the cane to produce at maximum potential. This must be done delicately, as damage to the cane will cause setback in growth, development and establishment. Consequently there will be a reduction in the cane's ability to establish itself and suppress emerging weeds. Herbicides used should be highly selective and cause no damage to young and germinating cane sprouts, yet have enough leaf activity to be effective against the full spectrum of weeds. From the list of current herbicides, those containing paraquat and glyphosate are not recommended for use at this stage.

The final application of herbicides can be at mid or late post-emergence. By this time weeds are fiercely competing with canes and will take more chemicals, better application and supervision, and a wider range of active ingredients to eliminate competition and guarantee reasonable cane yields. This is a situation to avoid since the cane crop might be damaged by the same chemicals, and the cost of the management activity will be relatively high. Herbicides used at this stage must have good foliar activity to effect complete burn down of established competing weeds.

Cost Effectiveness

Cost effective weed management therefore does not rely solely on herbicide treatments, but rather on providing the best growing conditions available to the cane crop. These include:

- the use of disease resistant varieties adaptable for the zone or region as recommended
- good land preparation to support rapid root development and crop establishment
- good quality seed pieces to foster early and rapid germination and growth
- optimum intra-row spacing to facilitate growth characteristics of the variety
- optimum stalk population arising from the use of seed rate recommended for each variety, and
- adequate soil moisture and nutrients to support cane crop at critical growth stages

Herbicides can only enhance the good weed management initiated at crop establishment. Without the support of good cultivation practices, weed control will be very costly, and less effective ✤

Variety Recommendations for Harvesting Periods & Soil Types

Cane-growing Area	Harvesting Period	Light Soils	Clay Loams	Clays
Westmoreland & Hanover	Early	BJ7555	BJ7452	BJ7465
		BJ7465	BJ7015	BJ7452
		BJ7015	BJ7555	BJ8252
		BJ7504	BJ7465	BJ7555
			BJ82105	BJ7015
				BJ7627
				BJ7504
	Middle	BJ7555	BJ7015	BJ7627
		BJ7504	BJ7938	BJ7938
		BJ7015	BJ82119	BJ82119
			BJ7555	BJ7015
			BJ7627	
			BJ7465	
			BJ7504	
	Late	BJ7627	BJ7627	BJ7627
			BJ7938	BJ7938
Irrigated Clarendon & St. Catherine Plain	Early	BJ7262	BJ7938	BJ7465
		BJ7015	BJ7465	BJ7555
		BJ7465	BJ7555	BJ7015
		BJ7627	BJ7627	BJ82102
		BJ82102	BJ82102	BJ82119
		BJ7555	BJ82105	BJ8252
			BJ8252	
			BJ7015	
	Middle	BJ7555	BJ7555	BJ7555
		BJ7548	BJ7548	BJ7504
		B78100	BJ82119	BJ7548
		BJ82119	BJ82105	BJ82102
			B78100	BJ82119
	Late	BJ7938	BJ7938	BJ7938
Upper St. Catherine & Upper Clarendon	Early	BJ7555	BJ7314	BJ7314
		BJ7465	BJ7504	BJ7504
		BJ7314	BJ7015	BJ7015
		BJ7015	BJ7555	BJ7465
			BJ82105	BJ7555
	Middle	BJ82119	BJ7015	BJ7555
		BJ7555	BJ82119	BJ7465
		BJ7262	BJ7465	BJ82119
		BJ7465	BJ7262	
			BJ82105	
			BJ7555	
	Late		BJ7938	BJ7938

Cane-growing Area	Harvesting Period	Light Soils	Clay Loams	Clays
St Thomas	Early	BJ7452	BJ7314	BJ7465
		BJ7465	BJ7452	BJ7555
		BJ82105	BJ7555	BJ7452
			BJ7627	BJ7627
				BJ7015
	Middle	BJ7465	BJ7627	BJ7627
		BJ7452	BJ7555	BJ7555
			BJ82119	BJ82102
			BJ7465	BJ7015
			BJ82105	BJ82119
	Late	BJ82119	BJ7938	BJ7938
			BJ82119	BJ82119
Trelawny St. James & St. Ann	Early	BJ7465	BJ7555	BJ7465
		BJ82119	BJ7015	BJ7015
		BJ8252	BJ7504	BJ7504
		BJ7504	BJ7465	
			BJ82105	
			BJ82102	
			BJ7938	
	Middle	BJ82119	BJ7015	BJ7938
		BJ7504	BJ7465	BJ7504
		BJ82156	BJ82119	BJ7465
			BJ7504	BJ7015
			BJ82105	
			BJ7938	
	Late		BJ7465	BJ7015
			BJ7938	BJ7938
St. Elizabeth	Early	BJ7015	BJ7015	BJ7938
		BJ7314	BJ82102	BJ82102
		BJ7465	BJ7465	BJ7465
		BJ7555	BJ7938	
			BJ82105	
			BJ7504	
	Middle	BJ7262	BJ8783	BJ7015
		BJ7314	BJ7465	BJ7465
		BJ8252	BJ82105	BJ7938
		BJ7465	BJ7938	
			BJ7015	
			BJ7504	
	Late	BJ7465	BJ7938	BJ7465
			BJ7314	BJ7938

The Editor
Sugar Industry Research Institute
Kendal Road, Mandeville