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Plenary paper

Enterprise-specific sustainable sugarcane production – making the most of what you've got!

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Abstract Sugarcane industries around the world are increasingly aiming at producing crops more efficiently and with fewer environmental consequences. Why would growers, irrespective of the scale of their operation, make changes to their on-farm production systems if they are not convinced that they will be successful? We suggest a process based on a logically derived framework that may guide the discussion, development and updating of plans and strategies for sugarcane-farming enterprises that are unique in terms of circumstances and drivers. This is particularly relevant as the idea of a sugarcane-growing 'recipe' is a misnomer. All sugarcane enterprises, irrespective of location, are undergoing change. Therefore, growers need to look to the future and use the best possible system that is suited to their individual/specific circumstances and driver. A fifteen-stage process uses a combination of grower 'study groups' (that provide support and enable peer review of on-farm practices and practice change, and comparisons and contrasts between different approaches on different farms); so-called strengths, weaknesses, opportunities and threats (SWOT) analyses; ASE&E assessments; risk assessments and risk-profiling; identification of priorities based on Hazard Analysis Critical Control Point (HACCP) processes; and performance assessment and feedback. The use of the proposed framework allows holistic analyses of possible strategies. The integrated approach ensures the best chance of success for a particular enterprise. The system may be used for existing and new enterprises, and for assessing established and novel approaches.

Key words Sugarcane, enterprise-specific practices, logically based process, adoption

INTRODUCTION

As with all agricultural commodity crops, sugarcane industries around the world are increasingly aiming at producing crops more efficiently and with fewer environmental consequences (Bhadha and Schroeder 2018). However, these overall objectives are highly dependent on the willingness and capability of growers, who are at the base of the production 'value chain', to embrace innovation resulting from research and development (R&D) programs. New or enhanced farming practices and systems that aim at improved sustainability (increased profitability in combination with continued environmental responsibility) will only be successful if they have been tried and tested, are practical and realistic, and appropriate for the specific circumstances of individual farming enterprises. Why would growers, irrespective of the scale of their operation, make changes to their on-farm production systems if they are not convinced that they will be successful, in line with personal preferences, and/or identified as solutions to actual or perceived imperatives? Such imperatives could be based on agronomic, economic, environmental, social and/or cultural pressures.

Here, we aim to stimulate discussions amongst sugarcane growers (irrespective of the size of their operation) and/or their advisors on how best to achieve their own objectives by understanding their individual circumstances, determining appropriate strategies, and adopting farming practices and systems that will suit their specific and industry needs. It is important that growers and advisors understand each other's opinions when making changes to strategies and practices. We suggest a process based on a logically derived framework that may guide the discussion, development and updating of plans and strategies for sugarcane farming enterprises.

SUGARCANE ENTERPRISES

Each farming enterprise is unique. They vary in their geographic location, position in the landscape, soils, the availability and state of natural resources, available capital, adoption of technology, age and skill of the grower and their economic focus. They are also highly dependent on a range of factors that affect their ability to produce sustainable crops at block and farm scales and beyond. These factors may be classed as external (when an individual grower has no or little control), semi-variable (dependent on the on-farm resources/characteristics), or variable (dependent on on-farm management and decision-making). This type of classification is not dissimilar from the breakdown of expenses associated with financial analysis/reporting in terms of fixed, variable and semi-variable costs (Kenton 2018). Adding to the validity of this comparison is the fact that sugarcane-farming enterprises (individual growers and their associated farms, corporate farms or co-operatives) are businesses that (should) aim to make annual profits (McGuire and Allsopp 2010). This means that sound agronomic, social, environmental and economic (ASE&E) management are needed to ensure ongoing viability (Poggio *et al*. 2016).

The factors mentioned above (external, semi-variable and variable) expose farming enterprises to risk, due to their unpredictability and/or resulting variability, more so in some cases than others. Adopting new or amended farming practices often adds further uncertainty due to a lack of experience and/or knowledge of the enterprise manager or operator when implementing or using these novel approaches on-farm. Growers are, therefore, not always ready, willing or enthusiastic to adopt farming innovations and/or systems derived from R&D (Schroeder *et al*. 2009) and other sources (Brett *et al*. 2019). This often results in stakeholders (including industry leaders, peak bodies, marketers, researchers, extension providers, enterprise managers, fellow growers, government representatives and the general public) questioning growers' attitudes and practices, especially when they have knowledge or opinions of so-called 'bigger-picture' issues that impinge on the future or viability of the industry. These may include missed opportunities for improvement (Johnson 2018), evidence of stagnated productivity (Garside *et al*. 1997), dwindling profitability (Autrey *et al*. 2018), degradation of natural resources (Meyer and Clowes 2013), real and perceived negative effects on the environment (Hurly *et al*. 2018), cultural inequalities (Mathias 2013; Gujja and Uphoff 2018), threats to social licence to operate (Kealley and Quirk 2016), shrinking global competitiveness (Autrey *et al*. 2018), and anti-sugar campaigns (Chudasama 2016). Such issues are extremely important because they may affect the viability and vibrancy of all players in a sugarcane industry. However, the individual grower is usually most conscious of factors that affect his/her farm directly and is usually only capable of making decisions about his/her particular enterprise (Loeskow *et al*. 2006; Schroeder *et al*. 2007).

Alternatively, he/she may be willing and/or able to contribute to, and/or partake in, collective decision-making and responsibility, and sharing of resources, ideas, inputs, etc. This is not unlike the roll-out of processes to enable growers to attain accreditation for use of best-management practices (BMPs) on their farms (Anon. 2019a). It could mean possible forfeiture of some resources, productivity, profitability, and real/perceived social and cultural values. Alternatively, authorities and industry may be willing to contribute financial support for growers to change practices (Anon. 2016, 2019b). These aim for collective maintenance/improvement of natural and farm-based resources, evaluation and introduction of updated methods and technologies, efficient utilisation of inputs and practices, and willingness to cause as little off-site effects as possible. However, this overall quest is only possible when it is recognised that each individual enterprise is unique with different circumstances, drivers and/or farming systems (Anon. 2019a), even though they sometimes only vary slightly.

A RECIPE FOR GROWING SUGARCANE – WHAT COULD BE EASIER?

Introductory remarks in several key publications and information sourced from websites (Anon. 2019c) often give the impression that sugarcane is a 'forgiving' crop that is relatively easy to grow! General descriptions indicate that sugarcane is a tropical grass grown extensively on a range of soils in countries located in tropical to sub-tropical environments. These locations suggest that there is abundant sunshine, average temperatures above 24°C, and annual rainfall exceeding 1200 mm, or where there are plentiful supplies of water for irrigation. Technical publications and guides on growing sugarcane (Humbert 1963; Hogarth and Allsopp 2000; Kingston *et al*. 2007; Meyer *et al*. 2013; Rott 2018a,b) indicate vegetative propagation from stalks of disease-resistant cultivars, and planting into different soil types in various row-spacing configurations. In these ideal production systems, this is followed by applications of commonly sourced fertilisers, common weed and pest controls, relatively simple irrigation methods (if needed), and harvests undertaken mechanically or by hand 12-months after planting or harvesting the previous crop. Ratooning covers several crops and re-establishment occurs either with or without fallow break-crops. What could be simpler? Just follow this general 'recipe'!

DISPELLING THE MYTH OF A 'RECIPE'

Unfortunately, the above descriptions tend to gloss over the intricacies and economics of producing high-yielding and/or profitable crops in the unique sets of circumstances that are a feature of every cane-growing enterprise. They also neglect to recognise temporal and spatial influences at a range of scales from within-block to across districts/regions. There is often no mention of differences in growers' capabilities and aspirations or the need for continual updating or adaption of tactical responses during and across seasons! The idea of a sugarcane-growing 'recipe' is therefore a misnomer! Sugarcane crop production should be based on sets of guiding principles that form the backbone of BMPs (Garside and Bell 2006; Schroeder *et al*. 2008).

The fundamental differences in farming enterprises are associated with: location; local, district and regional conditions; types and scales of operations; state, extent and availability of natural resources; extent and attitudes to capital investment; and physical access. These factors influence on-farm operations, require specific practices and inputs, and use of/access to appropriate equipment, machinery, services, and transport options. These requirements need integrated management with decisions covering ASE&E considerations. What is applicable in one particular set of circumstances may not be appropriate or feasible for another enterprise. However, irrespective of location, scale, climate, soil, etc, the most important consideration is voluntary commitment to on-farm BMP. This means managing individual enterprises in such a way that there is the best chance of minimising the risk of losses (Calcino *et al*. 2008; Hurney *et al*. 2008; Schroeder *et al*. 2009). These include losses in productivity (lower or under-achieved yields), losses in profitability (reduced income, unnecessary expenses, ineffective management and/or controls, etc), losses of applied inputs (leaching, run-off, and/or gaseous losses of nutrients, pesticides, etc), and losses of on-farm resources (soil erosion, degradation of soil fertility, off-site movement of water and organic matter, etc). This can only be achieved if growers fully understand their own sets of circumstances and adopt management practices that ensure recognition and adoption of this philosophy. Ultimately, this will also lead to innovation and adoption of new and/or alternative technologies that provide increased efficiency and/or improved ASE&E outcomes on-farm.

ADVANCES IN FARMING SYSTEMS, INNOVATION AND UPTAKE

Farming systems R&D conducted by different organisations, universities, government departments, etc. in many countries have greatly enhanced the ability to attain sustainable sugarcane production under different and variable circumstances and conditions. There are many instances of improved practices delivering realized value to industry that have been documented and included in manuals (e.g. Hogarth and Allsopp 2000, Meyer *et al*. 2013) and a plethora of scientific papers (e.g. Hogarth 2010, 2013; Allsopp 2016).

The development of improved sugarcane cultivars is often considered the most important contributor to gains in commercial cane sugar (CCS) and hence tonnes sugar/hectare (Cox *et al*. 2005, Cox and Stringer 2007). However, farming systems R&D is, in turn, recognized as being essential to ensure appropriate use and maintenance of on-farm resources, optimised inputs, sustainable yields, minimized costs and best use of genetic potential (Schroeder *et al*. 2009). This enables profitable sugarcane production within a continually changing/degrading physical, chemical and biological environment. Advances in farming systems R&D have resulted in extensive 'knowledge banks' in the areas of sugarcane agronomy/crop management, soil management, nutrient management, pest management and engineering enhancements (planting and harvesting).

Growers are not homogeneous in their capacity to assimilate this information and/or knowledge, or apply it on-farm. They learn and communicate in different ways. Some growers and enterprise managers are keen to exploit innovation, while others see the farm as a lifestyle choice. Their aims often reflect their age, social and cultural background (Hurly *et al*. 2018), their attitudes and reasons for farming – family-owned businesses, managing investor/company-owned enterprises or subsistence/small-scale operations. As such, they have a variety of business objectives (Plowman *et al*. 2008) that include maximising cane production (t cane/ha), maximising sugar production (t sugar/ha), maximising enterprise profit ($/t or $/ha), maximising return on investment, and/or simply making enough to live on! Characteristically, they fall into a number of groups (Vanclay *et al*. 1998) that range from so-called "innovators" (more enquiring, more prosperous and more risk-orientated) and "early adopters" (younger, more educated/inquisitive, tend to be community leaders and probably less prosperous), to the "early majority" (more conservative but open to new ideas, active in community and influential) and the "late majority" (older, less educated, fairly conservative and less socially active), to the "laggards" (very conservative, small farms and capital, oldest and least educated), and finally the "battlers" (barely surviving and scraping an existence slightly above or possibly below the poverty line).

ENTERPRISE-SPECIFIC SOLUTIONS

Several processes are available that may be used in an integrated way to enable growers to understand more clearly their own sets of circumstances and drivers, develop their own strategies, formulate and communicate their plans, and adopt or investigate appropriate systems to reach their specific objectives and targets. This type of approach will ensure that individual growers are in command of their own destinies, and that advisors' and external players' opinions and preferences are not unnecessarily forced onto primary producers.

The fifteen-stage process presented in Table 1 attempts to facilitate the above approach on-farm, irrespective of scale. It uses a combination of grower 'study groups' (that provide support and enable peer review of on-farm practices and practice change, and comparisons and contrasts between different approaches on different farms); so-called strengths, weaknesses, opportunities and threats (SWOT) analyses; ASE&E assessments; risk assessments and risk-profiling; identification of priorities based on Hazard Analysis Critical Control Point (HACCP) processes (Garmendia and Jensen 2015); and performance assessment and feedback.

Table 1. Process for facilitating enterprise-specific farming systems and practices.

Stage	Description	Explanation
1	Initiate process	Articulate the need for the approach and the process to interested users and stakeholders
2	Establish study group(s).	Establish study-groups of growers in specific districts or sub-districts to provide peer review of on-farm practices and practice change.
3	Collate relevant information	Source, collate, record and combine on-farm information for use in the next stages. This includes maps and spatial and temporally referenced data. This information is often based on the grower's knowledge and experience.
4	SWOT assessment	Undertake SWOT assessments to determine the fundamental operating environment for each participating growers/enterprise. Growers may prefer to undertake these confidentially. Both external and internal pressure on the enterprise need to be considered.
5	ASE&E analysis	Analyse the ASE&E implications for each enterprise. The economic and social analyses may be considered confidentially.
6	Risk assessment	Assess the risk-profile of each participating grower using a user-friendly risk assessment tool. This should include on-farm considerations and externalities (trends in climate, commodity prices, inputs costs, currency exchange, etc).
7	Establish enterprise objectives	Determine higher-level short-, medium- and longer-term objectives for each enterprise based on stages 3, 4 and 5 use specific, measurable, achievable, realistic and timely (SMART) criteria.
8	Determine an enterprise-specific action plan	Develop farming systems plan for each of the enterprises using existing know-how and addressing up to three priority operations/inputs using the HACCP approach.
9	Establish block-scale aims	Determined short-, medium- and longer-term objectives for specific blocks using SMART criteria.
10	Determine block-scale implementation and assessment plans	Establish "what, where, when and how" (WWWH) details and key performance indicators (KPIs). In terms of new or alternative practices, comparisons of changed practices with 'untreated' areas are essential.
11	Determine relevant ASE&E outcomes	Conduct quadruple bottom-line (ASE&E) assessments against objectives, aims and KPIs.
12	Assess implications for the enterprise	Determine whether outcomes would be applicable for more widespread usage.
13	Adopt, modify or amend outcomes	Put learnings into practice. Adopt those aspects of the farming systems that are relevant and suited to the farming enterprise. Amend or modify practices as appropriate.
14	Communicate with others	Interaction and communication with study group and other stakeholders to share learnings and experiences – positive, neutral or negative.
15	Continue cyclical learning	Loop back to previous stages as appropriate and/or as required. Continue with the process by fine-tuning or establishing new or amended inputs for further assessment and learning.

Although SWOT, ASE&E, risk and performance assessments are fairly well understood and routinely used for different purposes, especially in business circles, the HACCP approach needs further explanation.

The HACCP process may be used to prioritise issues that need attention in changing systems (e.g. on-farm management to ensure sustainable sugarcane/sugar production within specific enterprises). The enormous amount of information available can make it difficult for growers to identify the practices that are the most important to adopt and how to apply them correctly. Although the HACCP system was developed for the food industry to ensure high quality products with minimum health risks, it has provided the basis for other applications around the world (e.g. Tapia *et al*. 2009). The proposed HACCP-framework for sugarcane production in Australia (Garmendia and Jensen 2015) follows a logical process to ensure that the most relevant productivity drivers are managed in the best possible way. By managing the productivity factors step-by-step, the user can determine whether the resulting productivity and profitability show improvement or not. This framework aims at improving the management of the most limiting factors through a methodical system that has enough flexibility to be adapted to specific farms or enterprises.

However, it is important that required practice change undergoes thorough investigation to ensure that the viability of the industry is not compromised. It is therefore important that practice change is accompanied by at least a triple-bottom-line analysis, as suggested by Vanclay (2004) and Thompson (2007), but preferable by a quadruple-bottom-line analysis or ASE&E [as suggested here (Poggio *et al*. 2016)]. The integrated approach will enable the most appropriate strategies to be adopted on-farm within the identified short-, medium- and longer-term objectives and meet the needs of individual enterprises. This will have positive spin-off for the wider community and industry.

PROCESS FOR FACILITATNG CONTINUOUS IMPROVEMENT ON-FARM

Importantly, the cyclical learning and continuous improvement philosophy that underpins this approach means that growers will be able to build on their existing farming system or usual practices, with amendments allowing them to meet their own objectives and add to their own successes. They should also not be discouraged by initial setbacks or 'failures'. They should rather use the process to amend or modify their goals. The framework will assist enterprise managers to identify impediments to profitable production, help them determine potential solutions and facilitate ways to implement specific practices to address the identified constraints. These will be implemented in specific sugarcane blocks, and then be expanded onto the rest of the farm or enterprise as applicable.

Table 2. Attributes and appropriate biophysical considerations for growers when assessing their own sets of circumstances and drivers.

Attribute	Considerations
Location	1. Geographic - country, region, district, etc. 2. Climatic - tropical, subtropical, coastal, inland, etc. 3. Proximity to urban areas, infrastructure (mills, transport systems, roads), other infrastructure, sensitive environments, other enterprises, etc. 4. Access to power, water, equipment, expertise, and/or other.
Environmental and physical: enterprise	1. Climate – rainfall, solar radiation, temperature, etc 2. Landscape – hilly, alluvial, undulating, combination, etc, 3. Position in the landscape – crest, mid-slope, bottomland, etc 4. Orientation – south-facing, north facing, etc. 5. Slope – steep, gentle, flat, etc. 6. Drainage - potential for waterlogging or rapid drying. 7. Access to and/or need for irrigation.
Soils in each field	1. Parent material – alluvial, basaltic, granitic, acid volcanic, etc 2. Type – colour (red, brown, yellow, grey, etc.), texture (clay, silt, sand, loam, clay loam, etc.), structure (structureless, well-structured, massive, etc.). 3. Position in the landscape, orientation, slope, etc (as above). 4. Drainage and water-holding capacity. 5. Chemical properties (fertility, acidity, organic matter, cation exchange capacity, sodicity, salinity, etc.). 6. Biological properties (organic matter, microbes, invertebrates, micro-fauna, etc.). 7. Effective rooting depth. 8. Weed, pest and disease pressures. 9. Other capabilities or constraints.
Scale of enterprise	1. Production – area (ha) and productivity (tc/ha; ts/ha). 2. Uniformity – similar, diverse, scattered, etc. 3. Economies of scale – use of equipment and level and timing of operations, etc. 4. Access to, and use of, skilled labour. 5. Access to capital. 6. Other on-farm activities, crops and/or enterprises, off-farm activities, etc.

The initial collation of information and SWOT assessments are fundamental to the whole process. This enables each grower to understand his/her own specific set of circumstances and the drivers that impinge on the viability and prosperity of their enterprise. This may be used at different enterprise scales (various farms in different locations, single farms, sub-farm, block, etc). Different biophysical attributes for consideration by growers when assessing their own sets of circumstances are highlighted in Table 2. Risks and threats that need to be considered during the process described in Table 1 are summarised in Table 3.

Table 3. Risks and threats to farming enterprises at different scales.

Scale	Threat and/or risk	Possibilities
Industry / district or mill area	1. Decreased productivity	a) Overall declining soil health. b) Changing climatic conditions and/or severe weather events. c) Ineffectual sugarcane cultivars. d) Uncontrolled weeds, pests and diseases. e) Unchecked harvest losses f) Over-stringent regulations
	2. Decreased profitability	a) As above b) Increased input and production costs. c) Increased overseas or global production. d) Low world sugar prices. e) Subsidised sugar production in other countries and artificially cheap sugar. f) Changing markets and customer requirements. g) Changing interest rates and currency exchange rates. h) Sugarcane versus other crops on-farm.
	3. Increased social and environmental scrutiny	a) Over-zealous environmental standards. b) Over-stringent social licence to operate. c) Changing attitudes to sugar consumption. d) Over-stringent regulations and unachievable environmental targets.
Farm	1. Decreased productivity and profitability	a) As for industry/district or mill area. b) Unsustainable farm size. c) Unmanageable farming conditions and amelioration or rectification requirements d) Withdrawal of key herbicides and/or pesticides. e) New uncontrolled pest and diseases.
	2. Decreased viability	a) As above and the combination of threats and risks at industry/district levels. b) Isolation due to neighbours ceasing sugarcane production. c) Urban encroachment. d) Expropriation of land/ compulsory land transfers/acquisition. e) Adjacent to sensitive area. f) Farmer age and lack of younger generation. g) Changed or ceased mill ownership.
Block	Decreased productivity, profitability and viability	a) All of the above. b) Position in the landscape – drainage, flooding, off-site effects, etc. c) Soil type – sands (drought, low fertility, etc.), slay (water-logging, tillage constraints, etc), acid sulphate, sodicity, etc. d) Weed, pest and disease infestations. e) Uncontrolled water, pest, diseases and input management on neighbouring farms.

DISCUSSION

A full range of alternative farming practices and innovations for use on-farm may be assessed by using this system. This includes fairly well-established advances in farming systems such as green-cane harvesting (Wood 1986), reduced tillage, use of permanent beds, matched row-spacings and legume break crops (Garside and Bell 2006), improved drainage systems and laser-grading (Reghenzani and Roth 2006), irrigation scheduling (Ham *et al*. 2000), sustainable nutrient management (Schroeder *et al*. 2018), alternative pest controls (e.g. Samson *et al.* 2012; Turner 2013), and more socially acceptable practices (Kealley and Quirk 2016). However, it is also suited to novel and innovative applications such as precision agriculture (PA) (Bramley *et al.* 2018), aspects of crop modelling to support sustainable sugarcane production (Singels 2018), automated irrigation (Gillies *et al*. 2017), and automation and robotics (Brett *et al*. 2019).

The proposed system is aimed at enabling growers to develop and adopt practices on their farms that are suited to their own circumstances. Any changes that are made are supported by input from fellow study-group participants, advisors/facilitators, appropriate researchers, and importantly, the integrated assessment (ASE&E) on their own farms. They are then able to move forward with confidence and conviction, and with knowledge that the new or amended practices will be capable of delivering realised value to specific blocks and their enterprises. There will also be benefit to the wider community and industry because of effective delivery of extension messages that aim at increased productivity, profitability, environmental outcomes and improved social license to operate. The system, if used correctly will improve awareness of technological innovations, locally and internationally.

CONCLUSIONS

No one sugar industry or sugarcane enterprise is getting everything right in terms of their farming system(s). All sugarcane enterprises, irrespective of where they are, are undergoing change. Therefore, growers need to look to the future and use the best possible system that is suited to their circumstances and drivers. The use of the proposed 15-stage framework allows holistic analyses of possible strategies. The inclusion of SWOT, ASE&E, HACCP, risk and performance assessments ensure the best chance of success for a particular enterprise. The system may be used for existing and new enterprises, and for assessing established and novel approaches.

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Production de canne à sucre durable, spécifique à l'entreprise, pour tirer le meilleur parti de ce que vous avez!

Résumé. Les industries de la canne à sucre du monde entier cherchent de plus en plus à produire des cultures plus efficacement et avec moins de conséquences pour l'environnement. Pourquoi les producteurs, peu importe l'ampleur de leurs activités, modifieraient-ils leurs systèmes de production à la ferme s'ils ne sont pas convaincus de leur succès? Nous suggérons un processus basé sur un cadre dérivé logiquement qui pourrait guider la discussion, le développement et la mise à jour des plans et stratégies des entreprises de production de canne à sucre, uniques en termes de circonstances et de facteurs. Ceci est particulièrement pertinent car l'idée d'une «recette» pour la culture de la canne à sucre est impropre. Toutes les entreprises de canne à sucre, quel que soit leur localisation, sont en pleine mutation. Par conséquent, les producteurs doivent se tourner vers l'avenir et utiliser le meilleur système possible, adapté à leur situation et à leur dynamique propre. Un processus en quinze étapes utilise une combinaison de «groupes d'étude» de producteurs (qui fournissent un soutien et permettent un examen par les pairs des pratiques et des changements de pratiques à l'exploitation, ainsi que des comparaisons et des contrastes entre différentes approches sur différentes exploitations); les analyses dites «forces, faiblesses, opportunités et menaces» (SWOT); Évaluations ASE&E; évaluations des risques et profilage des risques; identification des priorités sur la base des processus d'analyse des risques et de maîtrise des points critiques (HACCP); et évaluation du rendement et retour d'information. L'utilisation du cadre proposé permet des analyses globales des stratégies possibles. L'approche intégrée garantit les meilleures chances de succès pour une entreprise donnée. Le système peut être utilisé pour les entreprises existantes et nouvelles et pour évaluer les approches établies et nouvelles.

Mots-clés: Canne à sucre, pratiques spécifiques à l'entreprise, processus logique, adoption

Producción sostenible de caña de azúcar para empresas específicas: ¡aprovechando al máximo de lo disponible!

Resumen. Las industrias de la caña de azúcar de todo el mundo tienen un enfoque de producir cada vez más, de manera eficiente y con menos consecuencias ambientales. ¿Por qué los productores, independientemente de su tamaño de operación, harían cambios en sus sistemas de producción en las explotaciones agrícolas si no están convencidos de que tendrán éxito? Sugerimos un proceso basado en un marco lógico derivado de un contexto que pueda guiar la discusión, desarrollo y actualización de planes y estrategias para las empresas de cultivo de caña de azúcar que son únicos en términos de circunstancias y manejo. Esto proceso es relevante, ya que la idea de una "receta" de cultivo de caña de azúcar es un nombre erróneo. Todas las empresas de caña de azúcar, independientemente de su ubicación, están experimentando cambios. Por lo tanto, los cultivadores necesitan mirar hacia el futuro y utilizar el mejor sistema posible que se adapte a sus circunstancias individuales/específicas y manejo. Un proceso de quince etapas utiliza una combinación de "grupos de estudio" de productores (que proporcionan apoyo y permiten la revisión por pares de las prácticas en la finca, el cambio de prácticas, y comparaciones y contrastes entre diferentes enfoques en diferentes granjas); los llamados análisis de fortalezas, debilidades, oportunidades y amenazas (SWOT); evaluaciones de ASE&E; evaluaciones de riesgos y elaboración de perfiles de riesgos; identificación de prioridades basadas en procesos de Puntos Críticos de Control de Análisis de Peligros (PCCAP); y la evaluación del desempeño y la retroalimentación. El uso del marco propuesto permite realizar análisis holísticos de las posibles estrategias. El enfoque integrado garantiza la mejor oportunidad de éxito para una empresa en particular. El sistema puede utilizarse para las empresas existentes y nuevas, y para evaluar enfoques establecidos y novedosos.

Palabras clave: Caña de azúcar, prácticas específicas de la empresa, proceso de base lógica, adopción