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EXPLORING PATTERNS: HOW TO TEACH WHEN THE SIGNALS SEEM TO BE MISSING?
Explorando Padrões: Como Ensinar Quando os Sinais Parecem Estar Faltando?

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Abstract
This paper presents the sequence of activities prepared to guide undergraduate students of ESP courses of the Schools of Agricultural Sciences of the Argentine National Universities of Córdoba, Catamarca and Villa María in the recognition of the Problem-Solution pattern in scientific texts of the agricultural domain. The ultimate goal is to find the best possible techniques to help non-native students of English and researchers discover the pattern in an attempt to add a new perspective to reading specialized text, i.e. a clause-relational perspective. Further research in this area will be carried out in the next three years.

Key-words: *clause relations; problem-solution pattern; reading comprehension; ESP.*

Resumo
Este trabalho apresenta a sequência das atividades preparadas para guiar os estudantes do curso de ESP na Escola de Ciências Agrícolas da Universidade Nacional de Córdoba no reconhecimento do padrão de Problema-Solução. O objetivo último é encontrar as melhores técnicas possíveis para ajudar os estudantes não-nativos do inglês e os pesquisadores a descobrir o padrão na tentativa de adicionar uma perspectiva nova à leitura de textos especializados: uma perspectiva clá-

usula-relacional. Pesquisas adicionais nesta área serão realizadas nos próximos três anos.

Palavras chave: *cláusula-relacional; padrão de problema-solução; leitura e compreensão; língua para fins específico*s.

2. Introduction

For readers to fully understand a scientific text it is essential that they comprehend its interrelation and structure, i.e. the connections between its constituents, instead of the meaning of individual sentences. According to Winter (1994: 48):

> *…the relations between the clause in its sentence and its adjoining sentences cannot be random or haphazard, and extending this beyond the sentence, the meaning of every sentence is a function of its adjoining sentences, particularly those which immediately precede it.*

Carrell (1985) and Meyer (1985), among other authors, have demonstrated that instruction in specific logical patterns of textual organization enhances reading comprehension.

The clause relational pattern object of our study is Problem-Solution (Winter, 1977**),** 1994; Gopnik, 1972; Hoey, 1979, 2001; Jordan, 1980, 1984). Basically, the Problem-Solution pattern consists of two components: Problem and Solution. In scientific discourse, however, this pattern may be supplemented by other structures: Situation and Evaluation of the Solution. These may or may not be present and they do not necessarily follow a fixed sequence.

Some of the variations described in the literature are:

- Introduction-Problem-Solution-Conclusion (Van Dijk, 1977).

- Situation-Problem-Response-Evaluation of Response (McCarthy and Carter, 1994).
- Problem-Potential Solution-Reject-Positive Evaluation (McCarthy and Carter, 1994).
- Situation-Problem-Response or Solution[1]-Evaluation (SPRE) (Hoey, 2001).

A priori, we decided to draw on Hoey's description of the structure. However, after the first pedagogical intervention, we saw the need to modify it. As a result of the pilot application of the first activity, a modification was done to the names of the different parts of the pattern which Hoey (1983) presents as SPRE: S standing for Situation, P for Problem, R for Response or Solution and E for Evaluation; this acronym coincides with the initials of its Spanish equivalents. The difference between Response and Solution is that a Response is considered a Solution only when the assessment is positive. Taking into account our students' educational background in the specialty, we substituted Evaluation (E) for Conclusion (C) – understanding by Conclusion, the assessment of the efficiency of the Solution provided. *C* will be used only in the materials provided to the students, since for them, the term *Evaluation* evokes the analysis, comparison and assessment of the probable responses or solutions that must take place *before* settling on a Solution and not *afterwards*. Therefore, the SPRE acronym was modified to read SPRC for the pedagogical practices. However, in this paper we use Hoey's terminology.

The structure of this pattern may be explicitly signalled and, thus, be easily recognized. However, "implicitness and explicitness will depend on what is being communicated to whom" (McCarthy, 1991:150). In cases where much of the information is implicit, the existence of the pattern can only be intuitively recognized on the basis of context. Sperber and Wilson (1986:174) have redefined the concept

[1] The difference between Response and Solution is that a Response is considered a Solution only when the assessment is positive.

of context which for them includes "(…) the information about the immediate physical environment (physical context), about previous utterances (linguistic context or co-text) and a set of assumptions stored in memory and deductively accessible which participate in the interpretation of an utterance (...)." By the Communicative Principle of Relevance (Sperber and Wilson, 1986, 1995), readers are entitled to assume that optimal relevance is embedded in the text by the writer and, thus, they interpret the text operating under the assumption that what is expressed in it is relevant ––– restricting *relevance* to relationships between utterances and interpretations.

Thus, once more it is not only decoding skills that are involved in the process of reading but also previous knowledge of the world which contributes to the activation of formal and content schemata. Readers have to activate their experience of the world and "constantly assess their interpretation (of the text) in the light of the situation and the aims and goals of the text as the reader perceives them" (McCarthy 1991:27).

Given the frequency of occurrence of the Problem-Solution pattern in texts of the domain of the Agricultural and Veterinary Sciences which our students are required to read, the teaching of this pattern became mandatory.

In this domain, key words rarely function in text structuring. The scarcity of explicit signals in these texts challenged us to devise an instructional sequence to make students aware of the existence of the pattern and, then, to guide them in its discovery on the bases of their background knowledge and the existing signalling devices.

An appropriate pedagogy in which teachers act as mediators between the authors' propositional intent (Sperber and Wilson, 1995) and the readers' perception should involve the study of signals in context. This needs to be supplemented with identification of signals as cues to reveal the authors' thread of meaning in order to help students to see how they function in context and to retrieve the meaning of the communication.

The texts our students read in the English class are intended for specialists in the Agricultural or Veterinary Sciences; thus, their authors presuppose the readers have the necessary background knowledge to fill in what is implicit. Authors convey meaning mostly by means of inference and little explicit syntactical or lexical signalling.

The piloting stage, which is part of a more comprehensive research that will be completed in the course of the next three years, has been undertaken in order to calibrate the instruments prior to their application to large groups. In the first stage of the research we concentrated on textual organization. Within the frame of text analysis we focused on the organization and signalling of the Problem-Solution pattern of scientific texts, the study of which has been going on for many years now but, to our knowledge, there exists no detailed account within the context of the Agricultural and Veterinary Sciences. Two self-compiled corpuses covering a range of topics in these fields were analyzed to determine the occurrence and characteristics of the pattern in the selected corpora. The results of this analysis highlighted the importance of background knowledge and co-text for the understanding of clause relations in the reading comprehension process.

The objective of this paper is to describe the methodological sequence designed to provide the students with the required information regarding the pattern whose lack of identification may constitute an obstacle to their comprehension and to supply them with sufficient practice to facilitate its recognition. The ultimate goal is to help novice non-native English students and researchers discover this pattern in an attempt to add an additional perspective to their approach to reading specialized texts: a clause-relational perspective.

The peculiarities of the population that will profit from the results of this study, most of whom neither have a good command of the English language nor are they yet specialists in their field of study, require that both materials designers and teachers should act as mediators between what the authors communicate and the information the readers would recover without explicit instruction in inferring information.

2. Methodology

2.1. Population characteristics

The student population that participate in the study are undergraduates randomly chosen in terms of sex and age. They all belong to the Schools of Agricultural Sciences of the Argentine National Universities of Cordoba (UNC), Catamarca (UNCat) and Villa María (UNVM). They are taking ESP reading comprehension courses in their respective Schools. Sixty students participated in the piloting experience whereas three hundred and thirty students will take part in the experimental application.

2.2. Methodological sequence and materials designed

We will first describe the methodological sequence for instruction in pattern recognition that we have designed to be used in an experimental application that will be implemented in the course of the research and, then, we will enlarge on the kind of activities elaborated for practice.

To comply with the methodological premise that language must be taught in context, a large number of scientific articles were carefully analysed in search of texts that present the pattern in such a way that it may be more readily identifiable by the students. This materials design decision was made considering that the texts were to be used for instructional purposes. In this experience, as in any other language teaching process, scaffolding is an inevitable, and desirable, step to help students bridge the gap of the Zone of Proximal Development (Vygotsky, 1978).

The teacher acts as mediator by drawing the students' attention to both lexical signals and relevant concepts. This is done by means of leading questions both in pre-, while- and post-reading activities which help stimulate the students' background knowledge hence forcing a dialogue between the reader and the text. Text interpretation is checked by means of activities in an attempt to elicit the different component

parts of the pattern and, on this basis, to focus the learners' attention on the learning problem.

Two reading comprehension evaluations were designed to act as pre- and post-tests to check students' identification of the Problem-Solution pattern and are at present being calibrated. For their design, the purpose of the tests and the target population were taken into account. Texts and tasks, rubrics and evaluation parameters were decided upon.

These tests were built keeping in mind the characteristics a test must have (Backman and Palmer, 1996): validity, reliability, authenticity and interactivity. In order to consistently measure what the tests intend to measure, content and construction validity were considered. The texts selected are representative of the kind of texts students and graduates are likely to read in the course of their professional lives. The interactivity dimension involves, besides the readers' knowledge of the world, the use of the foreign language, strategic competences and metacognitive strategies. These tests require that evaluators be trained and the correction criteria standardized. The data collected will be analysed by means of paired T-tests.

The pattern in the first text, which acts both as a triggering activity and as a pre-test, is quite obvious since it is by means of the word "problem" that the Problem is introduced. The teacher, then, presents the pattern and makes explicit reference to form, sequence, variations and frequency of occurrence of the pattern as well as to the parts of the scientific article where it is likely to be found. Students are advised as to the way in which the pattern may be detected: namely, by overt lexical signalling or by inference with reference to the readers' background knowledge. In the study that serves as the basis for this work, Pérez de Pereyra and Aguilar de Espinosa (2007) hypothesized that

> *…. the written corpus analysed would be likely to yield a heavy usage of self-evident lexical signals and cohesive devices. We expected to find lexical signals in number and quality that could be used to orientate the students in the recognition of the pattern; however, in most cases, it is context, in Sperber and Wilson's (1995) terms, that transforms lexical terms such as "deficiency", "difficulty", "disadvantage", otherwise of everyday usage, into signals.*

The progression of the practice activities is based on the long standing language teaching principles of Comenius[2] (in Mackey,1965:205), i.e. from the easy to the difficult, the near to the remote, the general to the special, the known to the unknown, the simple to the complex and from the analogous to the anomalous.

The rubrics and the texts are in English in all but the first activity. The texts are authentic in the sense that they are written by specialists for specialists and also because they allow students to confirm or extend their knowledge about the different topics. They are representative since they have not been modified to include signals for the recognition of the Pattern that would normally not occur in scientific texts of this specialty.

After the presentation of the learning problem, students are given six activities progressively increasing in length and in degree of difficulty as determined by McLaughlin's (1969) SMOG[3] grading.

All the activities[4] presented below are being piloted with a group of undergraduate students; so far only the first two ones have.

[2] "Larger units should be taught before smaller ones and the material should be arranged so that the few come before the many, the brief before the long, the simple before the complex, the general before the particular, the near before the remote, the analogous before the anomalous and the regular before the irregular" Comenius in Mackey (1965:205).

[3] SMOG, Simple Measure of Gobbledygook, is a formula to assess the educational level needed to fully understand a text. (http://www.wordscount.info/hw/smog.jsp)

[4] Note that all articles used on the activities have been authorized by the authors and editors.

1. Activity Nº 1: Given a text, students should recognize the pattern in the mother tongue. Both the rubrics and the texts are in Spanish to minimize the degree of difficulty and help students focus on the pattern.

ACTIVITY Nº 1

Pre-reading activity:

- ¿Qué aromáticas conoce?
- Lea rápidamente el título y diga a qué aromática se refiere el texto y qué sabe de ella.
- Lea el texto siguiente. Se trata de una adaptación de un artículo de AGRISCIENTIA, (2004, VOL. XXI (1): 39-449, cuyo título y autores se consignan más abajo. En él se presenta el patrón Problema-Solución (SPRC). Subraye en dónde se encuentra cada una de sus partes constituyentes e identifique su función.

ALTERNATIVAS DE CONTROL QUÍMICO DE MALEZAS ANUALES EN *MENTHA PIPERITA* L.[5]

Darré, C.A.; R. J. Novo; G. Zumelzú y E. R. Bracamonte

A efectos de establecer medidas de control químico de malezas anuales en M. piperita se realizaron ensayos con herbicidas en Río Primero en diferentes condiciones de cultivo.

Las mentas son especies herbáceas de ciclo perenne que contienen aceites esenciales, dentro de los cuales se destaca el mentol. Por sus características, este aceite tiene creciente demanda en las industrias cosmetológicas, alimenticia y medici-

[5] Source: DARRÉ, C.A.; NOVO, R. J.; ZUMELZÚ, G. AND BRACAMONTE, E R. 2004 Alternativas de Control Químico de Malezas Anuales en Mentha piperita L. *Agriscientia*, **XXI,**1: 39-449**.**

nal. Paralelamente crece la necesidad de desarrollar técnicas de cultivo más eficientes, entre ellas las de control de malezas. Tradicionalmente el control de malezas se realiza mecánicamente y, en menor medida en forma manual.

En preplantación de la menta, el herbicida de presiembra pendimentalin no afecta el cultivo en tanto que la trifluoralina lo afecta levemente. Ambos controlan eficientemente las malezas anuales.

Post-reading activity:

- ¿Qué palabras o expresiones le ayudaron a distinguir cuál es el problema descripto?

2. Activity Nº 2: Given a text, the students should first recognize where the Problem is stated, this time in the target language, and, then, choose the Solution from the three options provided. (Number of words: 129; readability: 14.75)

ACTIVITY Nº 2

Read the following text carefully and

- Underline the sentence(s) where the Problem is stated. Circle the word(s) that indicate the Problem.
- After you identify the Problem, choose the correct Solution to the Problem from the alternatives provided.
- Do the exercise below

VIRUSES OF POACEAE: A CASE HISTORY IN PLANT PATHOLOGY[6]

Plumb, R.T.

Until the 1970s *Barley yellow dwarf virus* (BYDV) was an interesting, but not especially relevant, virus in the UK. Very

[6] Source: PLUMB, R.T. 2002 Viruses of Poaceae: a case history in plant pathology. *Plant Pathology*, **51**: 673-683.

late-sown spring barley, 'cuckoo barley', was occasionally badly infected, but the cause of such infection and the yellowing that resulted was often misdiagnosed. Winter wheat, when sown in October or later, was not obviously infected. Oats, both winter- and spring-sown, were acknowledged as at risk, possibly because of the rather more spectacular symptoms on these hosts, but, as an increasingly minor crop, and often grown where BYDV was not a serious problem, attracted little interest. So, when I proposed experiments on oats sown in September, to test the hypothesis that the earlier the crops were sown in the autumn, the more likely they were to be infected with BYDV:

1. There was concern about the widespread use of pesticides and an alternative approach was preferred.
2. I further proposed that an organo-phosphorous chemical, phorate, be added to the seedbed to see if it would protect against the aphid vectors of BYDV. The basis of the hypothesis came from evidence that was accumulating about the phenology of the aphid vectors of BYDV from the Rothamsted Insect Survey (RIS).
3. The evidence for increased risk infection from early autumn sowing was clear as it brought newly emerging plants into potential contact with large populations of aphids, almost exclusively *R. padi* (Plumb, 1992).

- Do the following exercises:
    - Check by means of a tick(**P**) which of the following crops are cereals
        - oats
        - potatoes
        - rice
        - carrots
        - wheat
        - maize
    - What factors may negatively affect cereal crops?

3. Activity Nº 3: Given two texts, students should identify the one in which the pattern occurs and indicate its different constituent parts. (Text 1: Number of words: 255; readability: 11.55; Text 2: Number of words: 262; readability: 10.11)

ACTIVITY Nº 3

Read the following texts and

a. say in which of them the authors present the SPRC pattern.

- when you have found it, indicate the different parts of the Pattern in the text. In each case, circle the term(s) that helped you discover the SPRC.

TEXT 1

CHEMICAL COMPOSITION AND IN VITRO DIGESTIBILITY OF WHOLE-CROP PEA AND PEA-CEREAL MIXTURE SILAGES GROWN IN SOUTH-WESTERN QUEBEC[7]

A. F. Mustafa and P. Seguin

The objective of this study was to determine the chemical composition and in vitro dry matter (IVDMD) and neutral detergent fibre (IVNDFD) digestibilities of silages made from whole-crop pea [Pisum sativum L. (PS)], pea-wheat [Triticum aestivum L. (PW)], pea-barley [Hordeum vulgare L. (PB)] and pea-oat [Avena sativa L. (PO)] mixtures harvested 8 weeks (H8) and 10 weeks (H10) after seeding. Forty-five days after ensiling, all forages were well ensiled as indicated by low pH and low water-soluble carbohydrate content and high lactic acid concentration. Regardless of forage type, crude protein (CP)

[7] Source: MUSTAFA, A.F. AND SEGUIN, P. 2004 Chemical Composition and In Vitro Digestibility of Whole-Crop Pea and Pea-Cereal Mixture Silages Grown in South-western Quebec. *J. Agronomy & Crop Science*, **190**: 416-421.

and IVNDFD were higher while starch and acid detergent lignin were lower in H8 than H10. However, harvest date had no effect on neutral (NDF) and acid (ADF) detergent fibre of the silages. Within each harvest date, CP was higher while NDF was lower for PS than pea-cereal silages. Differences in CP and fibre fractions between the pea-cereal mixture silages were not consistent for the two harvest dates. The IVDMD of PS was higher than that of the three pea-cereal mixture silages in H8 but was only higher than that of PB in H10. For the pea-cereal mixtures, IVDMD was higher for PO than PB and PW in H8 and was higher for PB than PW in H10. It was concluded that silage from pea monoculture had similar forage yields and a generally higher nutritive value than silages from pea-cereal mixtures.

TEXT 2

HOW TO HANDLE HARDPAN[8]

M. McGrath

Millions of gardeners rely on their tillers for everything from preparing a perfect seedbed to turning under cover crops and even stirring their compost piles. But a 3 year study at Alabama's Auburn University raises cautions about tiller use by people who garden on sandy topsoils that sit just above a finer textured subsoil. Tiller use on this type of soil can cause a "hard pan" problem—a 2 to 4 inch thick area of compacted soil caused by the downward force of the rotating tiller blades as they pound the already-much-harder soil under that sandy top layer.

When hard pan develops underneath a fluffy seedbed made by the tiller, it can prevent the roots of the plants in that bed from reaching deep enough into the soil to obtain water during dry periods. The pan can inhibit drainage during wet weather.

[8] Source: MCGRATH, M. (ed.) 1996 How to Handle Hardpan. *Organic Gardening*, **43**,4: 19.

If you have a problem pan, you can still use your tiller, but sparingly and only till when the soil is not too wet or too dry. This is good advice for tilling in any soil; it preserves the soil porous "crumb" structure, which allows water and nutrients to move easily to plant roots. You can also double dig your beds to loosen the subsoil, or grow deep rooted cover crops like alfalfa to break up the pan for you.

Dr. Mitchell and Charles Elkins are working on perfecting a slit-tillage attachment that they and fellow coastal gardeners could use on their tillers to cut a thin slice through hard pans much as farmers do.

4. Activity Nº 4: Given a text, and after identifying the different components of the Pattern which appears in a linear order, students should fill in a table with this information. (Number of words: 258; readability: 17.40)

ACTIVITY Nº 4

- In the following text the SPRC follows the pattern described. Read the text carefully and complete the table below. In each case circle the term(s) that help you discover the SPRC constituents.

BIOLOGICAL CONTROL OF BROWN ROT (*MONILIANA LAXA* EHR.) ON APRICOT (*PRUNUS ARMENIACA* L. CV. HACÝHALILOÐLU) BY *BACILLUS*, *BURKHOLDRIA*, AND *PSEUDOMONAS* APPLICATION UNDER *IN VITRO* AND *IN VIVO* CONDITIONS[9]

Mustafa Altindag, Mustafa Sahin, Ahmet Esitken, Sezai Ercisli, Muharrem Guleryuz, M. Figen Donmez and Fikrettin Sahin

[9] Source: ALTINDAG, M.; AHMET, E.; SEZAI, E.; MUHARREM, G.; D. FIGEN, AND FIKRETTIN, S. 2006 Biological Control of Brown Rot (*Moniliana laxa Ehr*.) on Apricot (*Prunus armeniaca L. cv. Hacýhaliloðlu*) by Bacillus, Burkholdria, and Pseudomonas Application under In Vitro and In Vivo Conditions. *Biological Control*, 38,3: 369-372.

Apricot is the most important fruit crop grown in Anatolia, with approximately 300,000 tons of fruit produced annually, and Turkey is the biggest apricot producing country in the world. Malatya province is the main apricot-producing area not only in Turkey but also in the world, and the main apricot cultivar grown in Malatya is Hacýhaliloðlu which is known to be susceptible to brown rot.

Brown rot caused by *Moniliana laxa* Ehr. is one of the most destructive diseases of apricot. This pathogen is able to destroy the whole annual crop in the phase of blossom, although it can kill shoots up to 30 cm beyond the initial blossom infection. Management of brown rot in Turkey is in general carried out by fungicide application. Since the chemical control presents disadvantages such_as high power consumption, soil, and environment pollution and pesticide residues in fruit. Recently, there has been increased interest in environmental-friendly sustainable agricultural practices. Therefore, nonchemical management strategies like biological control need to be developed and used for effective control of brown rot disease on apricot. A number of bacterial strains identified in previous studies were reported as potential biocontrol agents against many fungal and bacterial pathogens. Some of the previous studies showed that *Burkholdria gladii* (Syn: *Burkholdria pyrrocinia*) OSU-7, *Bacillus subtilis* (Syn: *Paenibacillus macerans*) OSU-142, and *Pseudomonas putida* BA-8 have great potential with antagonistic activity against plant pathogenic bacteria and fungi as well as growth promoting effect. However, the effect of these bacteria application on control of brown rot disease in apricot has not yet been reported.

Situation	
Problem	
Solution	
Conclusion 1	
NEW Problem	
NEW Solution	
Conclusion 2	

5. Activity Nº 5: Given a text, and after identifying the different components of the Pattern which does not appear in a linear order, students should fill in a table with the corresponding information. (Number of words: 258; readability: 17.34)

ACTIVITY Nº 5

In the following text the SPRC does not follow exactly the Situation, Problem, Response, Conclusion order. Read the passage carefully and complete the table below.

AN OUTBREAK OF CONTAGIOUS BOVINE PLEUROPNEUMONIA IN NGAMILAND DISTRICT OF NORTH-WESTERN BOTSWANA.[10]

Amanfu W, Masupu KV, Adom EK, Raborokgwe MV, Bashiruddin JB.

(Veterinary Record).

Abstract

An outbreak of contagious bovine pleuropneumonia (CBPP) in the northern part of Botswana in 1996 was contained through eradication of all heads of *cattle* in Ngamiland district (Ngami East and West) in the period April 1996 to February 1997. This disaster posed a serious threat to those who depended on the livestock sector for sustenance and to the *nutrition* security of the population, especially the under five's. *Aim:* The aim of this study was to assess the impact of the *cattle* eradication on the nutritional status of children. *Method:* A secondary analysis of existing data from the Botswana National *Nutrition* Surveillance

[10] AMANFU, W.; MASUPU, KV.; ADOM, E.K.; RABOROKGWE, M.V. AND BASHIRUDDIN, J.B. 1998 An Outbreak of Contagious Bovine Pleuropneumonia in Ngamiland District of North-Western Botswana. *Veterinary Record*, **143**,2: 46-48.

System enabled us to study the impact of this disaster on malnutrition in the under five's by comparing quarterly malnutrition rates for Ngami East with national figures for the period of January 1995 to March 1998. *Results:* While the risk for malnutrition among under five's in Ngami East increased from 0.046 to 0.105 during the study period, giving a relative risk of 2.299, the increase in risk for Botswana was from 0.133 to 0.139, giving a relative risk of 1.048. The attributable risk for *cattle* eradication impact on malnutrition was 4.6% for Botswana and 54.4% for Ngami East. *Conclusion:* The *cattle* eradication impacted seriously on the food and *nutrition* security of the under five's in Ngami East, compared with the country as a whole.

Situation	
Problem	
Solution	
Conclusion	
New Problem	
Solution	

II.

In Spanish summarize the SPRC in this case.

6. Activity Nº 6: Given a longer text, students show their recognition of the Pattern by underlining and labelling the constituent parts and by answering some content questions. (Number of words: 872 readability 16.36)

ACTIVITY Nº 6

Read the following text and

- indicate the different parts of the SPRC pattern.
- underline and label each of the component parts.
- answer the questions below

MANAGEMENT OPTIONS FOR MINIMIZING THE DAMAGE BY ASCOCHYTA BLIGHT (ASCOCHYTA RABIEI) IN CHICKPEA (CICER ARIETINUM L.)[11]

Y.T. Gan, K.H.M. Siddiqueb, W.J. MacLeod b, c and P. Jayakumara

1. Introduction

Chickpea (Cicer arietinum L.) is one of the world's most important grain legumes, and the seed is a major source of plant-based dietary protein for humans. This annual legume is a significant contributor to agricultural sustainability through N2-fixation and as a rotation crop allowing the diversification of agricultural production systems. World chickpea production has increased steadily in the past two decades, and in 2003 production reached 7.1 MT, ranking third behind dry bean (Phaseolus vulgaris L.) at 19.0 MT, and field pea (Pisum sativum L.) at 10.3 MT (FAO, 2004). The average seed yield of chickpea varies from <390 to >3600 kg/ha, depending on environmental conditions and crop management for biotic and abiotic constraints.

Ascochyta blight, a disease caused by Ascochyta rabiei (Pass.) Labrousse, is the major constraint limiting chickpea productivity worldwide. The disease occurs in major chickpea growing areas of the world (Nene and Reddy, 1987, Kaiser and Muehlbauer, 1989, ICARDA, 1996, Akem, 1999, Khan et al., 1999, Kaiser et al., 2000 and Chongo et al., 2003b). The build-up of inoculum in areas with intensive production of chickpea or with short crop rotations has contributed to the severity of epidemics. This disease reduces chickpea seed yields and quality significantly, and in some circumstances yield losses for susceptible cultivars

[11] GAN, Y.T; SIDDIQUEB, K.H.M.; MACLEOD, W.J. AND JAYAKUMARA, P. 2006 Management Options for Minimizing the Damage by Ascochyta Blight (Ascochyta rabiei) in Chickpea (Cicer arietinum L.). ***Field Crops Research,* 97**,1: 121-134.

are as high as 100% (Reddy and Singh, 1990a). Economic losses due to blight damage have been substantial in many regions including Australia (Ackland et al., 1998 and Knights and Siddique, 2002), Canada (Chongo and Gossen, 2001), Latin America (Kaiser et al., 2000), southern Europe (Trapero-Casas and Jiménez-Díaz, 1986), the United States of America (Kaiser and Muehlbauer, 1989), and West Asia (Akem et al., 2000).

Development and use of integrated disease management is the key for successful production of chickpea. In this review, we discuss the key crop management practices with emphasis on strategies and options that can be used to minimize the damage caused by this disease. We summarize all possibly available crop management information from major chickpea production regions of the world, aiming at providing chickpea producers with practical tools to manage the disease effectively and economically. This review did not cover aspects other than agronomic management options. Detailed biology of the pathogen–host relationship, pathogenicity, and the methods of pyramiding resistant genes into genetic materials have been reviewed by Pande et al. (2005) in a recent publication. Another review by Jayakumar et al. (in press) has discussed the symptoms, possible infection mechanisms, and chemical and biological components that contribute to resistance and the breakdown of the resistance in chickpea

……

7. Conclusions

Damage caused by ascochyta blight in chickpea can be minimized by use of moderately resistant cultivars integrated with strategic agronomic management practices. Worldwide chickpea breeding efforts are continuing to pyramid ascochyta resistant genes from various sources including wild Cicer species. These efforts will eventually result in greater resistance in the host plant and broaden the opportunities for agronomic management to maximize chickpea productivity. In the interim,

it is essential to integrate all available agronomic options into a management package to minimize the damage caused by the pathogen. The use of ascochyta blight-free seed will reduce the probability of transmitting seed-borne disease to the seedlings. Seed for commercial production of chickpea should be tested for presence of the pathogen, and then treated with an effective fungicide. Stubble-borne inoculum can be minimized by tillage practices designed to deeply bury the crop stubble whenever practicable or by burning the crop straw wherever permissible. In warm and moist areas of the world where residue breaks down quickly, only 1–2 years of non-host crops between chickpea crops are required to reduce the levels of stubble-borne inoculum to manageable levels. In contrast, in areas where crop residue breaks down slowly, especially in cooler climates, a 3 or 4 year crop rotation is required between chickpea crops. In areas where ascospores are the major source of inoculum, the use of field isolation and sowing chickpea at a distance from previous chickpea crops, will reduce the density of airborne ascospores released from infected debris. Ascochyta blight pressure can also be minimized by the use of optimum sowing date, deep sowing, optimizing plant density, balanced nutrition, and alternative sowing patterns, where these are possible.

Foliar applications of fungicides effective against ascochyta blight are, however, still required for reliable production of partially resistant chickpea cultivars. Most of the fungicides with known efficacy are preventive, and therefore, prophylactic sprays should be applied before the occurrence of infections in short-season producing areas. For winter-sown chickpea, several applications of foliar fungicides are required for season-long protection especially when severe epidemics are expected. In areas where ascospores are the major sources of inoculum, the application of foliar fungicides at seedling stages is crucial to minimize the impact of intense showers of ascospores. When multiple applications are required during a growing season, alternating different types of fungicides will minimize the probability of the development of fungicide-resistance. The

development of decision support systems (or forecast models) based on relationships between weather variables and the disease development will assist managers to make strategic spray decisions.

a. Why is chickpea an important crop?
b. Which is the pest described here? Does it constitute a problem? Back up your answer with information quoted from the text.
c. What are the measures, if any, devised to counteract it?
d. Have the authors evaluated the crop response?
e. Which cues did you detect that helped you answer the questions above? Quote the text.

3. Discussion

The text in Activity N°1 presents an interesting example of Hoey's (2001:37) conception of Situation which states that there is a *good* and a *bad* evaluation within every Situation. "The function of a 'good' evaluative element within the Situation is to put the Problem —– which is a 'bad' aspect of the Situation —— into the larger context of 'good' aspects of the Situation." In this case the *good* evaluative element can be recognized in the following paragraph:

> a. Las mentas son especies herbáceas de ciclo perenne que contienen aceites esenciales, dentro de los cuales se destaca el mentol. Por sus características, este aceite tiene *creciente demanda en las industrias* cosmetológicas, alimenticia y medicinal.[12]

This evaluative dimension precedes the *bad* aspect or Problem as illustrated by:

[12] See English Translation in the Appendix 1.

> b. Paralelamente *crece la necesidad* de desarrollar técnicas de cultivo *más eficientes*, entre ellas las de control de malezas.[13]

The Solution to this Problem is mentioned in the same paragraph; it may be inferred from the word *control*:

> **…** *control* de malezas. Tradicionalmente el control de malezas se realiza mecánicamente y, en menor medida en forma manual. [14]

Whereas, the word *control* in other contexts, such as Psychology or Sociology, may have a completely different connotation, our students will recognize it as a proposed Solution due to their knowledge of the specialty; that is to say, this is a case of recognition by inference.

Finally, in this example, the reader may only identify the Evaluation of the traditional Solution as negative by inference. The new Solution proposed by the authors is perceived by means of the proximity of the propositions in which they offer a more efficient Solution recognizable by means of the word *herbicida*:

> 3. Tradicionalmente el control de malezas se realiza mecánicamente y, en menor medida en forma manual.
>
> En preplantación de la menta, *el herbicida* de presiembra pendimentalin no afecta el cultivo en tanto que la trifluoralina lo afecta levemente. Ambos controlan *eficientemente* las malezas anuales.[15]

Let us refer now to the second activity. The piloting of this exercise showed its appropriateness. In the text there is an abundance

[13] See English Translation in the Appendix 1.
[14] See English Translation in the Appendix 1.
[15] See English Translation in the Appendix 1.

of lexical signals to guide the readers to the recognition of the Problem by means of terms such as *virus, badly infected, such infection, misdiagnose, at risk*, and of the Solution by means of the expression *protect against,* thus providing sufficient scaffolding for a first activity in the foreign language.

As regards the third activity, the Pattern is present only in text 2 where the Situation is introduced by means of a generalisation: *millions of gardeners rely …* Although in the course of research we have noticed that the word "problem" as a lexical signal is rather infrequent, in this particular text it clearly introduces the Problem:

"Tiller use on this type of soil can cause a 'hardpan' *problem*".

It is also signalled by the verbs *can prevent* and *can inhibit* which support the notion.

The Solution is shown by means of conditional sentences whose main clauses clearly express advisability. For example:

> "*If* you have a problem pan, you *can still use* your tiller but sparingly …. You *can also double dig* your beds to loosen the subsoil or *grow* deep-rooted cover crops…"

The authors provide a brief Evaluation: "This is *good* advice for tilling in any soil, it *preserves* the soil porous "crumb" structure,…" in which they explicitly assess the Solution provided since for our students preservation of the soil is known to be a desirable aim.

In Activity Nº 4, the Pattern appears closely following the SPRE model. The students, by having to fill in a table, are led to discover it and are taken a step further into the recognition of one of the variations of this Pattern: the report of a new Problem which results from the negative evaluation of the first Solution and is consequently followed by a new Solution and its Evaluation.

The rationale for the selection of the fifth activity was the need to expose the students to a text in which the SPRE order is not followed. Actually, the order of presentation is: first the Problem; then, the Situation or context where it occurred and, in the third place, the statement of a

Solution which was appraised and found to create a new Problem. By means of a fill-in-the-table exercise, the students have to identify the component parts of the Pattern. In this way, they will be able to contrast the SPRE pattern with and without variation.

Finally, for the sixth activity we selected a longer scientific article; only its Introduction and Conclusion were used for this last activity so that the students can complete the task within a class period. In the Introduction of the article, the Situation, the Problem and the Solution appear in a sequence, which makes it easier for the students to detect the SPRE pattern. The Evaluation is not mentioned in the Introduction. In the Conclusion there is a brief mention of the Problem: "Damage caused by Ascochyta blight in chickpea" and the Solution is presented first and described at length below. There are only a few instances of Evaluation. In the Conclusion, there is also an abundance of lexical signals such as *disease, cause*, *constraint, epidemic, damage* and others to point out the Problem. Whereas, *disease management*, *crop management, minimize the damage* are markers of the Solution. The Evaluation is signalled by lexical expressions which can be exemplified by:

… is crucial to minimize the impact
will eventually result in greater resistance
fungicides with known efficacy are preventive …

In this last task the students are asked to answer comprehension questions in an attempt to guide them in the discovery of the SPRE and also in the detection of the lexical signals.

Finally, the students are given a post-test to evaluate their efficiency at the recognition of the pattern.

3. Conclusion

The design of a sequence of activities with the purpose of awakening the students' awareness regarding a pattern of high frequency in scientific articles of the Agricultural and Veterinary domain is not an

easy task; particularly given the level of linguistic competence of the population to which it is directed. Students need to be trained to be able to recognize the signalling, but in the absence of evident lexical signals they have to work harder— taking advantage of their background knowledge— in order to find the relationships intended by the writer and, to this purpose, the teacher once again acts as mediator.

In this paper we have attempted to do only the basic groundwork; the approach presented here, by means of different reading activities in which some lexical signalling was evident, has practical pedagogical applications since we have tried to systematize the presentation of the pattern and, thus, to provide a clearer picture of how the SPRE is signalled, how it can be perceived by the readers and, in this way, to enhance their reading efficiency.

In the light of the results obtained in the limited pilot experience, we can affirm that the methodological approach proposed, so far, fulfils our expectations. However, we are not able to report results at this moment since the activities have only been applied to a statistically small population. Further research in this area will be carried out in the next three years.

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APPENDIX 1

Translation of the fragments of the text in Activity Nº 1 used for exemplification:

a. Mints are perennial herbaceous species which contain essential oils, among which menthol is the most prominent. Because of its characteristics, the demand for this oil is increasing in the cosmetology, food and medical industries.

b.At the same time, there is a growing need to develop more efficient cultivation techniques, among them those used for weed control.

c. …weed control. Traditionally, weed control is mechanically, and to a lesser degree, manually done. In mint pre-planting, the pre-sowing herbicide pendimentalin does not affect the crop whereas trifluoraline affects it slightly. Both of them effectively control annual weeds.

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