THE TETRAZOLIUM TEST FOR SOYBEAN SEEDS

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illustration

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cover

Soybean seeds with different lesions caused by stink bug
(Photo: J. B. França Neto)

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FOREWORD

The evaluation of soybean seed physiological quality has been a major task for seed technologists. This is due to the influence of several factors which can affect seed quality in each phase of the soybean production system. The tetrazolium test has contributed to screening this factors and pointed out the most important ones.

Embrapa, through its National Center for Soybean Research, at Londrina, Parana, has been contributing to improve the methodology of the tetrazolium test for over 20 years, through several studies developed by the Seed Technology research team. Their objective was to provide a powerful tool to the seed industry and to seed research programs to obtain more reliable information related to the seed quality evaluation.

The result of this work along those years culminated with this publication, which is released to share the knowledge with all Seed Science community.

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1 INTRODUCTION

The production and utilization of high quality seeds of soybean [*Glycine max* (L.) Merrill] are important and basic keys for the success of the crop. To achieve these requisites, the quality control program of the soybean seed industry must be versatile and dynamic, thus promptly providing accurate results. Several determinations, such as varietal and physical purity, moisture content and level of mechanical damage, can be evaluated within minutes, thereby partially fulfilling these requirements.

The time-consuming determination of viability by the germination test presents a serious limitation to the entire process of decision making within the seed industry. In addition to this limitation, the germination test provides very restricted information that is most reliable when ideal conditions are provided for the seed. For example, the results provided by the test are frequently affected by imbibitional damage (França Neto *et al*, 1997) and can be severely influenced by seed infection by different pathogens, such as *Phomopsis* spp., *Fusarium semitectum*, and *Colletotrichum truncatum* (Henning and Franca Neto, 1980; Franca Neto and West, 1989a, 1989b). Such limitations of the test may result in serious losses to the seed producers, since they negatively affect

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the decision making with regards to several seed production practices, such as harvesting, processing, storage and commercialization.

Faster and more comprehensive results than those provided by the germination test are provided by the tetrazolium (tz) test. In addition to germination potential, the test also provides a vigor index, and reveals the causes of seed weakness, such as mechanical damage, field and storage deterioration, stink bug damage, and damage to heat and frost. The identification of the causes of seed weakness and its feedback to seed producers will enable them to make corrections to promote improved soybean seed quality in future crops.

This diagnostic feature, provided by the tz-test, is responsible for the high level of its adoption by soybean seed analysts in Brazil. Additionally, due to the publication of the first versions of the present manual (França Neto *et al.*, 1985; França Neto *et al.*, 1988), and due to the intensive training offered by seed specialists of Embrapa and other institutions, the test is performed in all seed laboratories in Brazil that deal with soybean seeds. As a consequence, Brazil is today the world leader with regards to the utilization of this test. Some numbers illustrate this leadership: one million tons of soybean seed were used in sowing 12.5 million hectares of the crop in 1997. This volume represented approximately 100,000 seed lots. Considering that 80% of these seed lots were evaluated at least twice by the tz-test, during the quality control process, close to 160,000 tz-analyses were performed in 1997, with soybean seed only.

The use of the tetrazolium test in Brazil stands not only for its quantitative aspects, as illustrated by the numbers presented above, but mainly for its qualitative features. The performance of the tz-test, in conjunction with other tests, assures that only the seed lots that effectively have good quality will be placed in the market. This fact has resulted in a more reliable seed quality control system, warranting good profits to the seed producer, by the production of high quality seed at a low cost. According to frequent feedback from several seed producers, the use of the tz-test has decreased to levels of seed lot replacement and replanting to indexes close to zero.

Several aspects about the tz-testing of soybean seed will be considered in this manual: a) the major events and accomplishments which contributed to the development and perfecting of the test; b) the basic principles of the test; c) necessary equipment and supplies; d) procedures for seed preparation and

evaluation; e) basis for the correct interpretation of the results; f) advantages and limitations of the test; and g) accuracy of the results.