

Chapter I

Introduction

Sorghum (*Sorghum bicolor* (L) Moench) grows in the wild in northeast Africa, and its spread from its origin has occurred since 1000 B. C. In America, the first introduction was made during the time of the slave trade. A second round occurred between 1874 and 1908, when several subspecies were brought into the country (Smith, 1995).

Today sorghum ranks fifth among the world's major cereal crops. The total production in 1992 was 63.6 million tons. In the United States, it is ranked third behind maize and wheat, with production of 16.2 million tons (FAO, 1991; USDA, 1992).

Sorghum is adapted to drought stress, which allows it to grow in some of the world's less favorable climates. Morphological and physiological responses under drought stress make this plant unique among the cereals. The capacity of sorghum to fold its leaves and a layer of wax over the leaves reduce evapotranspiration. The root system of sorghum is bigger and deeper than that of maize (*Zea mays* L.). Sorghum plants also have the capacity to remain relatively inactive during drought and renew growth when the conditions are favorable (Bennett et al., 1990).

Sorghum's drought tolerant characteristics allow production in semi-arid regions of the world. Producers on the plains of Oklahoma and Texas have turned from maize to grain sorghum as a feed grain source as irrigation water supplies have dwindled. Eighty percent of U.S. production of sorghum comes from Kansas, Texas, and Nebraska (USDA, 1994). In 1992, sorghum was planted on approximately 5.4 million ha, in the U.S., with a yield average of 4,566 kg/ha and a farm value of over \$1.7 billion (USDA, 1993). The international trade of sorghum shows Japan as the biggest consumer of U.S. sorghum production, with 53% of the exports, followed by Mexico with 40% (USDA, 1966).

Because of seasonal drought in some parts of Virginia, the interest for growing sorghum has increased. Farmers have reduced maize acreage and increased sorghum acreage. Virginia's sorghum production increased from 2,874 ha and 8,717 tons in 1987 to 5,285 ha and 21,379 tons in 1992 (USDA, 1994). Grain sorghum in Virginia is a profitable crop, in spite of the fact that some production problems remain. Problems include poor seedling vigor, inadequate stands, bird damage, harvesting difficulties, and lack of an adequate market (Virginia Tech, 1995).

The poor vigor of sorghum seedlings has been studied by several researchers. Most of the work has been done in semi-arid tropical or subtropical regions, where poor crop establishment is one of the major problems limiting production. Limited establishment research has been done in temperate areas, and results show that seeds of some sorghum cultivars are better able to germinate under unfavorable conditions than seeds from other cultivars.

Analyses of seed germination and laboratory methods to predict seed germination under field conditions are scarce, even though in many published papers the correlation between seed germination under field and laboratory conditions have been made. The results of such research are inconsistent. The variations can perhaps be explained largely by the confounding effects of environmental factors.

Vigor and germinability are important manifestations of seed quality. The germinability of a seed is defined as the ability to germinate or produce a normal seedling in a standard germination test, usually performed under optimal growth conditions (ISTA, 1985; AOSA, 1986). Vigor has been defined as the sum of all those qualities which determine the level of seed activities and performance potential, usually under suboptimal conditions (Perry, 1987). The vigor test is an important component of seed testing. This kind of test can presumably reflect a seed's potential performance or vigor, where vigor is defined as the capacity of the seed to germinate under adverse and optimal conditions (AOSA, 1983).

Observations of sorghum fields planted in Virginia often show poor stand establishment (Khosla, 1995). Poor stand are generally a result of several environmental and intrinsic seed factors. Attention in this research is given to vigor of the seeds and its consequence on stand establishment. The purpose of this research is to compare the field emergence of several sorghum hybrids and to correlate emergence with several seed vigor evaluation methods. The practical goal would be to develop a laboratory method to predict the amount of seeds needed in planting and to avoid poor stand establishment due to poor emergence.