Understanding seed, variability, environmental impact and management as factors influencing the success of pastures. (2) Variability.

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This is the second article in a short series that will cover the factors addressed in the title

Variability or variation in a crop determines the ability of a crop to survive and produce under different climatic conditions. Depending on the reproductive method the plants use to produce their seed we will find that the progeny from that crop is either very variable or that variability is reduced by selection methods or inherent seed producing processes.

In landraces, variability is determined by natural selection which is a result of climatic conditions, cultivation method, and what seed is saved for the next generation. Several landraces are very successful i.e. South African Standard lucerne.

In this case lucerne seed produced in various areas of South Africa was cleaned in a central cleaning facility from which it was sold and redistributed to lucerne producing areas. The different environmental areas resulted in many cycles of natural selection which eventually resulted in hardy plants with medium production potential but with a strong tolerance to various root diseases and little to no tolerance to lucerne aphids, as they were not present in South Africa. When lucerne aphids were introduced to South Africa the whole South African lucerne industry came to the verge of extinction. However, even though there was a real crisis, some plants, even never before being exposed to the aphids survived. This is very typical of what would be expected of cross pollinating plants which inherently produce seed with large variability.

In the case of lucerne this had two consequences. Firstly, it led to the design of a major National Lucerne Evaluation Programme (NLEP) through which overseas cultivars were evaluated at various climatic areas in South Africa, and then released to the industry, and secondly the development, through selection and breeding of a new cultivar selected from South African Standard and now

available in the trade as S A Select, which has tolerance to three types of lucerne aphids.

Several landraces of maize are also very successful as the result of open pollination and the saving (keeping) of seed to sow in the same area, resulting in plants that are well adapted to local conditions. However, there is very little guarantee that such a landrace will be successful in a different climatic area.

It is also a fact that with plants with edible seed, there is often a slight negative selection pressure as the good seed is consumed as food while the slightly poorer seed is kept for the establishment of the next generation. Although the genetic composition is determined by the parent population we often find that weaker seed will result in poor establishment, weaker seedlings and lower production.

The forage plant breeder strives to produce cultivars of forage crops that are distinguishable from other cultivars, uniform and stable. By doing this cultivars are bred/selected for specific environmental conditions and management practices.

Therefore one would find that in self pollinating crops, like cowpeas, variation is naturally low and certain cultivars will be more adapted to specific climatic conditions. In fact most cultivars/ landraces were just formed by natural selection or by farmers selecting for certain characteristics. The cultivar cv. Encore was, however, selected for its specific ability to re-grow after grazing, therefore making it a true grazing crop that could produce one to two grazing cycles and thereafter be left to still produce a grain harvest for human and animal consumption.

Even cross pollinated crops are usually selected for one or more characteristics that make them adaptable to specific environmental or stress conditions. Although characteristics selected for in the breeding programme, i.e. tolerance to rust in rye grass are stabilised, the population can still be variable enough to ensure dramatic adaptability to varying climatic conditions.

A good example of variation linked to growth characteristics is the different dormancy classes of lucerne cultivars. Although certain dormancy classes will be better suited to specific environments we may find that stand in pastures can be very similar in closely related dormancy classes. Therefore one may find that a higher dormancy class cultivar, may produce very well in optimal environmental conditions, but will also produce in sub-optimal conditions, due to the variation that spans several dormancy conditions.

Let us think of a cultivar with dormancy 8 and variation A B C D E F and a cultivar with dormancy 9 and variation C D E F G H. In a environment favouring B C D E, both cultivars may be adapted as both have characteristics that can excel in the environment, however, we must realise that the variation is genetic variation and exists in the seed. After germination natural selection would take place due to environmental pressures and both cultivars may have the ability to produce a fully

adapted lucerne stand that includes the characteristics B C D E that are required for success.

In conclusion, the variability present in self pollinating and apomictic crops is limited and may confine the crop adaptation to very specific environmental conditions. Cross pollinating crops are normally adapted to a wider range of climatic conditions and management practices due to greater genetic variability, however, the genetic composition of the population that results in the eventual pasture could differ from one environment to another as only the plants adapted to a specific locality (environment) will survive and successfully produce.