Advances in Crop Science and Technology

Mini Review Open Access

Quantitative Genetics is Used in The Breeding of Autogamous Plants

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Abstract

With the increasing demand for food, it is necessary to use alternative methods and solutions that increase the efficiency of inbreeding. The use of quantitative genetics plays an important role in this, especially when pedigree methods are used in inbreeding plants. This study proposes to inform the progeny relationship using the best unbiased linear predictor to obtain breeding values with higher accuracy and thus, increase genetic benefit from selection. One proposed strategy is to speed up the program of collecting purebred perennials and to use as much information as possible in the selection process to achieve maximum accuracy. In this way, it is possible to produce better hybrid lines than existing lines, with a higher frequency, to meet agro-industrial needs related to perennial crop production.

Keywords: Food; Hybrid; Crops

Introduction

Plants considered inbreeding are those with dominant self-pollination, that is, with a cross-fertilization rate of less than 5%. Specific breeding strategies are used in the propagation of these plants. Available information indicates that the propagation of this plant has been successful in different parts of the world. The two most traditional methods for separating the progeny of self-breeding plants, the mass method and the pedigree method, were proposed in Europe in the late 19th and early 20th centuries. [1], other selection methods have been proposed to minimize the disadvantages of the two methods mentioned above. Among them, the mass method in F2 or F3 generations and single-grain generation (SSD) has also been widely used. Comparisons between these methods have been made over time, and although in some cases differences have been found between them, it has been found that if they are applied well, they are equally effective fruit.

It can be deduced that, although this has occurred in some cases, the use of quantitative genetics to assist breeders in self-pollinating plants is much less than that used for pollinating plants. cross. In tandem with the expected population growth in the coming decades, the demand for food will grow markedly. Since there is not much fallow land left, the main option to meet the demand for grains, fruit and fiber is to increase production. One of the alternative solutions to increase yield is to improve crop management. This is the backdrop for the increasing use of fertilizers, pesticides and irrigation water [2-6]. However, there are some limitations to the increased use of these inputs; some due to availability and price limitations and others due to possible environmental impact issues.

Thus, it is hoped that an increase in productivity can be achieved specifically through genetic improvement. In this context, new alternatives are proposed to help identify more and more productive inbreeding fish. One of these options is to use more knowledge from quantitative biometric genetics. In this study, several possibilities of using quantitative genetics will be discussed, with emphasis on selection of autocrossing plants, especially when pedigree methods are used.

The pedigree method is the most used method in the selection of inbred plants and the method used can be found in many publications. This is to discuss a strategy to improve its effectiveness. Among the advantages of the genealogical method, the advantage that is always mentioned is that it is possible to obtain the degree of consanguineousness between generations, or in other words [7-10].

We have the genealogy of selected people of the same bloodline. . This information is almost always available; however, its use, as this happens, is very limited. Its use should be more obvious, especially given the work required to obtain it, in order to improve the effectiveness of the method. An alternative to the use of genealogy has been presented by computer simulation. A quantitative trait with heritability considered in a purely additive genetic model; in other words, there is no dominance and bleeding phenomenon.

Plant breeding in the pedigree method

The comments made will focus on the cultivation of Coffea arabica, but can be extrapolated to any self-pollinating perennial. Coffee was chosen because it is a crop of great economic and social importance in Brazil. Breeding programs are conducted exclusively by the public sector. The breeding method used to date consists of promoting segregated populations by means of pedigree. It is known that the main difficulty in genetic selection of any species is to reduce the influence of environment and genotype-environment interaction on phenotypic expression, or in other words to have a representative good for genotype in phenotype [11] . In perennial crops, such as coffee, this factor is even more pronounced when the tree has a long immature period and markedly fluctuating annual yields, which need to be assessed over several years. What is proposed is a strategy to speed up the program to obtain new inbreeding, while, at the same time, using as much information as possible in the selection process for maximum effect. Base populations can be obtained using any of the options used by breeders of this species. However, the ideal situation is the involvement of parents with a proven track record in crossbreeding whenever possible; in other words, advocate overcoming the good. As an indication, segregating populations will be obtained by crossbreeding between the ten best inbreeding individuals available. These hybrids will be selected on the basis of their outstanding performance, mentioned above, in terms of yield, pest resistance and grain quality. Ideally they come from various existing breeding programs. Parallel crosses may be

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Received: 01-May-2023, Manuscript No: acst-23-98525, **Editor assigned:** 03-May-2023, PreQC No: acst-23-98525 (PQ), **Reviewed:** 17-May-2023, QC No: acst-23-98525, **Revised:** 19-May-2023, Manuscript No: acst-23-98525 (R) **Published:** 26-May-2023, DOI: 10.4172/2329-8863.1000577

Citation: Shiwani P (2023) Quantitative Genetics is Used in The Breeding of Autogamous Plants. Adv Crop Sci Tech 11: 577.

performed or, to facilitate, superior crosses, where each in breeding is a test of all the others. The F1 seeds obtained from each superior cross will be crossed in equal numbers, yielding 10 segregating populations. F1 generation plants will be sown under cultivation conditions. During the first harvest, after 2 years, the seeds of each F1 plant will be crossed in equal proportions to obtain an F2 population. In this case, at least 100 F2 plants from each of the top hybrids will be used, creating a total population of 1000 plants [12-15]. These plants will be identified. In the first harvest, for example, a soft selection will be performed, using a selection intensity of 50% or 500 individuals. From each selected individual 3 plants per tree are obtained to obtain F2: 3 residents. This will be done in the field using one-plant plots with three replicates, in other words, a total of 1500 plants.

Discussion

All breeding programs should be as dynamic as possible. The proposal presupposes that inbreeding crosses will convert to VCU's use and cultivation value after 18 years. Obviously, this procedure cannot meet the needs of the coffee farming industry in Brazil. It is necessary to provide new crosses every four or five years. The way to achieve this goal is through a periodic breeding program using the strategy mentioned. For this purpose, descendants will be selected after two harvests. During the selection process, the top 10 offspring, preferably from dominant crosses with different parents, will be crossed in the same manner as mentioned above. If new inbreeding crosses come from other breeding programs or have demonstrated resistance to pests or pathogens, they can and should be included in recombination. The process from then on will be similar to the one detailed earlier. With this strategy after the first cycle, new inbreeding lines can be generated every four to five years, which makes the program much more efficient. This strategy has certain advantages. (i) It allows more dynamism in perennial breeding programs such as coffee. This proposal is consistent with a periodic breeding program. From this generation, the best progeny can be recombined and also inbreeding lines from other programs and sources of pest and disease resistance must be included in the recombination process. (ii) Deciding the best progeny at each step, especially from , is done more precisely because the number of replicas involved in the process is very large. (iii) The ability to identify offspring with higher stability and adaptability. From what has been mentioned above, this fact is clear. It should be emphasized that stability can be appreciated both in terms of years and locations, as well as the rotating nature of biennial returns. (iv) Can evaluate a lot of information that can help breeders make future decisions, such as comparing interactions between progeny years and progeny positions. Various analysis options can be evaluated, such as the use of least squares and mixed modeling methods, especially BLUP, moving averages, sequential analysis with the use of BLUP, etc. Furthermore, in this case, genealogy can be used as an additional criterion, as mentioned above. Genomic selection, which has received a lot of attention recently, may have demonstrated its effectiveness in propagating perennial plants. It can also be used to estimate genetic and phenotypic components, especially identified heritability, which is not common in the case of coffee growing and many other alternatives would give allowing future breeders to make much more certain decisions.

Conclusion

Parallel crosses may be performed or, to facilitate, superior crosses, where each inbreeding is a test of all the others. The F1 seeds obtained from each superior cross will be crossed in equal numbers, yielding 10 segregating populations. F1 generation plants will be sown under cultivation conditions. During the first harvest, after 2 years, the seeds of each F1 plant will be crossed in equal proportions to obtain an F2 population. In this case, at least 100 F2 plants from each of the top hybrids will be used, creating a total population of 1000 plants. These plants will be identified. In the first harvest, for example, a soft selection will be performed, using a selection intensity of 50% or 500 individuals. From each selected individual 3 plants per tree are obtained to obtain F2:3 residents. This will be done in the field using one-plant plots with three replicates, in other words, a total of 1500 plants.

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