Trans. Nat. Acad. Sci. & Tech. (Phils.)
1987,9:415-423

A STUDY ON THE *GLIRICIDIA SEPIUM* (JACQ.) WALP. GERMPLASM COLLECTION IN VISCA

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ABSTRACT

Gliricidia sepium (Jacq.) Walp germplasm collection was undertaken to determine the phenological characteristics and growth habit of the different accessions and to evaluate the growth rate and survival of this species propagated through seeds (sexual) and cuttings (asexual/vegetative).

Different accessions were collected all throughout the Philippines and from abroad. Local accessions collected were usually bushy, shrubby and short-statured having short, broad leaves. Foreign accessions were arboreal with lesser side branching and the leaves were small to large in size and elliptically-shaped. Number of leaflets per rachis varies from branches to branches and from tree to tree.

In terms of plant growth among those propagated through seeds, Accession No. VGs 15 grew to 4.55 m, the tallest among the accessions and also developed the biggest diameter increment (3.08 cm) at one year of growth. However, at the second and third year of growth, Accession No. VGs 6 was noted as the tallest and the biggest diameter increment obtained, 6.73 m high and 4.75 cm dbh and 7.58 m high and 5.63 cm dbh, respectively.

On the other hand, those propagated through cuttings, Accession No. VGc was found to be the tallest (4.26 m) and biggest diameter (2.83 cm) at one year of growth. However, during the second and third year of growth, Accession No. VGc 2 prominently grew faster, 6.11 m high and 4.50 cm dbh and 6.63 m high and 4.89 cm dbh, respectively.

This development showing promising results prompted the researchers to undergo studies on flowering and fruiting behavior, hybridization and rapid propagation techniques to develop new promising hybrids of *G. sepium*.

Introduction

Gliricidia sepium (Jacq.) Walp is a fast-growing leguminous tree of the Family Fabaceae and found as a good material for reforestation programs. It can survive in impoverished soil and can easily be propagated by cuttings. The normal development of the root system, however, is slow and the mortality rate is rather high during transplanting. Despite these drawbacks, asexually propagated plants are superior than seedlings because they develop shoots, leaves and branches in a very much shorter time the moment they get established.

Wherever *Gliricidia sepium* grows, its hard, heavy wood is used for fuel. Although not tall, the tree produces much branch wood and coppices easily. Its calorific value is 4,900 kcal per kg (NAS, 1980).

Sumberg (1983) cited that in any trials of tree plantations, local species should always be given top priority since they are already adjusted to the existing environmental conditions. Those trials might provide the germplasm materials to start local tree plantation for pulp and paper manufacture, firewood and other research purposes.

A germplasm collection has been established and this paper reports the study on the phenological characteristics and growth habit of the different accessions and the growth rate and survival of plants propagated through seeds and cuttings from different localities in the Philippines and abroad.

Materials and Methods

Collection of planting materials

The *G. sepium* seeds and cuttings were raised in the nursery for 1½ months and then hardened for a month in hardening beds for preconditioning of the seedlings. The seedlings were watered from time to time. Nursery data were recorded. In some cases, direct planting of cuttings in the plot was done.

Field site preparation and planting

Before planting, the area was thoroughly prepared. Existing vegetation and weeds were removed to prevent competition for light, soil nutrients and soil moisture between the seedlings and weeds. Planting was done at the onset of rainy season. Weeding of the area was performed periodically or whenever necessary.

In outplanting, 20 seedlings and/or cuttings in each accession were selected randomly for field trials. The spacing used was 1 m x 1 m and the sample seedlings in each accession were then planted in the plots.

Soil sampling and analysis

The following soil properties were determined initially and at the third year of experiment.

1. soil pH
2. organic matter
3. total nitrogen
4. available phosphorus
5. extractable potassium
6. soil texture

Data collection

The data collected were the following:

1. percentage survival of seedlings/cuttings
2. plant height (m)
3. stem diameter (cm)

The initial plant height and diameter were taken immediately after outplanting and every 3 months thereafter. Succeeding measurements were done at 6 months interval when the seedlings had attained 1 year or more in growth.

Sample accessions were selected among the collection. Three accessions were selected to represent local collection propagated through seeds and three accessions for those propagated through cuttings (local). Three accessions were used also to represent the collection from abroad.

The selection of sample plants was based on the growth dominance, age and superior tree characteristics attributed to trees for hybridization and improvement of varieties according to specific use.

Hybridization

The breeding work considers the characteristic traits of the accessions–both foreign and local. These traits include branching habit, growth form–either erect or bushy; disease and drought resistance; leaf characteristics among others.

Results and Discussion

Nursery and field trials

Planting stocks of *G. sepium* were raised on the nursery for evaluation of germinative capacity of seeds and cuttings of different accessions. Conditioning of the seedlings was done before conducting outplanting in the field. Selection of vigorous seedlings for field trial planting was performed to ensure survival rates in actual field conditions. Most of the accessions propagated through seeds were found to be vigorously growing at 80-100% survival rate. On the other hand, those propagated through cuttings showed high mortality during the seedling stage. This might be due to long drought which occurred sometime in 1983 during the initial stage of the study. Inspite of this drawback, those accessions that survived and got established were already growing vigorously.

In the early part of 1985, some local accessions started to flower but failed to produce pods. This was attributed to the fact that these accessions were still too young hence, the probability of the pollination process not to proceed normally, resulting in the failure of the plants to bear pods. It was observed also that pollens were shed off or anthesis took place while the flowers were still unopened. This means that either the species was cleistogamous or there was a strong self-incompatibility mechanism present. However, during the first to second quarter of the

third year (1986), several accessions both local and foreign, had borne flowers and developed pods but the seeds produced were aborted. Further verification of this phenomenon has been undertaken to induce the production of viable seeds.

Plant growth and development

Plant height and diameter at breast height of representative *G. sepium* accessions were noted (Table 1). At one year old, Accession No. VGs 15 was observed to be the tallest (4.55 m) and the biggest in terms of diameter increment (5.08 cm, dbh) among the selected accessions. Accession No. VGc 2 (Fig. 2) on the other hand, was the shortest (3.33 m) with Accession No. VGs 13 having the smallest diameter increment (2.20 cm, dbh) compared to other accessions selected. At two years of growth, Accession No. VGs 6 (Fig. 3) was noted to grow very fast and developed bigger diameter, 6.73 m and 4.73 cm, dbh, respectively, while Accession No. VGs 13 and VGs 2 were the shortest 5.33 m and 3.49 cm. dbh and 5.42 m and 3.48 cm, dbh, respectively.

Table 1. Mean annual plant height and diameter growth of representative *G. sepium* accessions in the germplasm collection[1]

	One Year of Growth		*Two Years of Growth*	
Accession number[2]	*Plant height (m)*	*Diameter at breast height dbh (cm)*	*Plant height (m)*	*Diameter at breast height dbh (cm)*
VGs 2[3]	3.27	2.22	5.42	3.48
VGs 4	3.46	2.33	5.44	3.61
VGs 6	4.03	2.73	6.73	4.75
VGs 13	3.43	2.20	5.33	3.49
VGs 15	4.55	3.08	6.46	4.54
VGs 16	4.39	2.36	5.75	3.51
VGs 1	3.43	2.56	5.78	3.99
VGs 2	3.33	2.51	6.11	4.50
VGs 4	4.26	2.83	6.05	4.36

[1]Based on mean of 20 sample trees per accession
[2]VGs – *G. sepium* propagated through seeds.
VGc – *G. sepium* propagated through cuttings.
[3]VGs 2 – Caniaw, Bantay, Ilocos Sur (northern part of the Philippines)
VGs 4 – Buhisan, Cebu City (Central part of the Philippines)
VGs 6 – Nicaragua
VGs 13– Catbalogan, Samar (Eastern part of the Philippines)
VGs 15– Central America N118, OFI #31/83
VGs 16– Chaing Mai, Thailand N 79
VGc 1 – Mabalodbalod, Tigaon, Camarines Sur
VGc 2 – Kagiang, Buhisan, Cebu City
VGc 4 – Camp 7, Osmena Reforestation Project, Minglanilla, Cebu

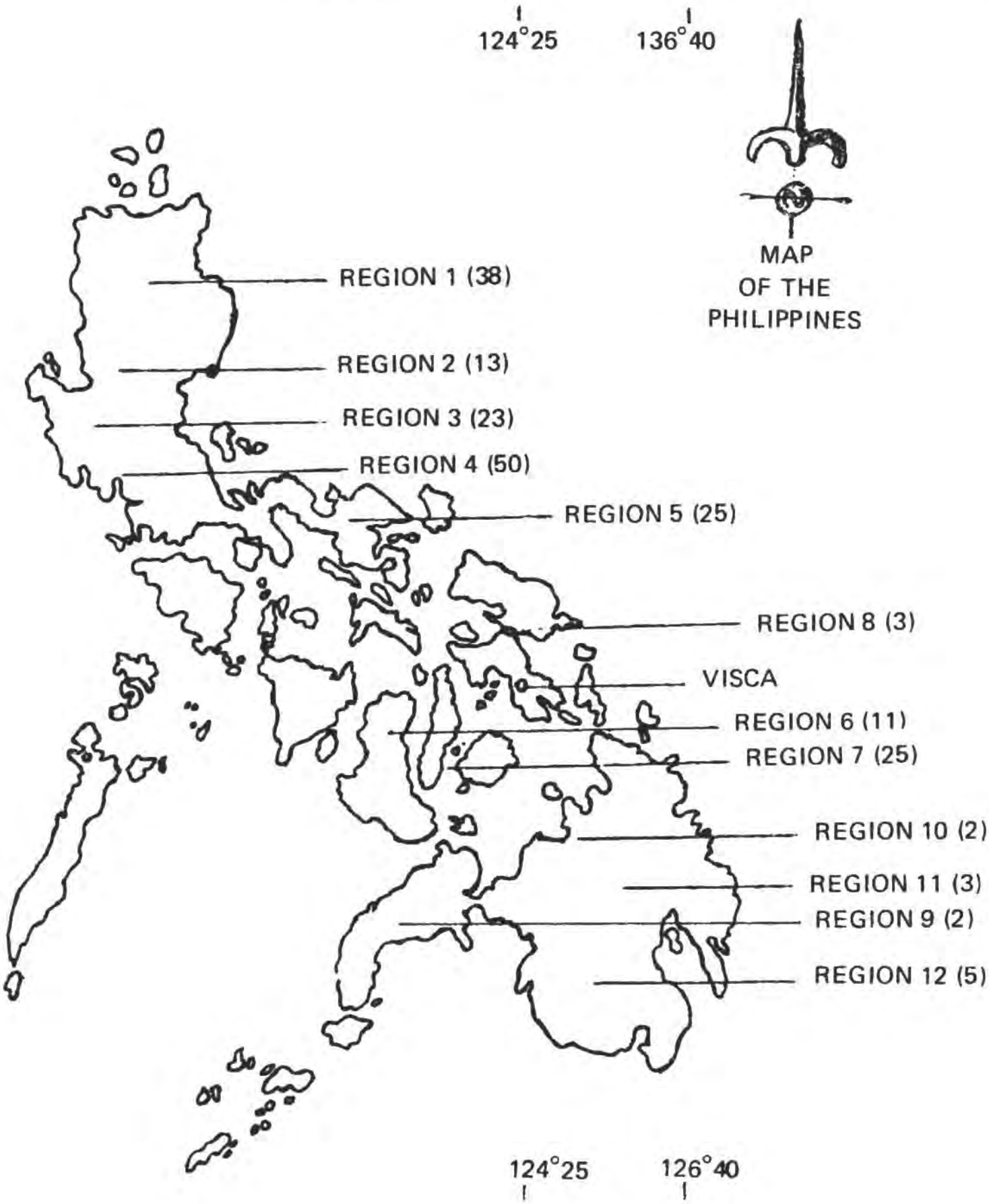

Fig. 1. Relative locations where *G. sepium* were collected in the country. Numbers in parenthesis are number of accessions in each place.

Fig. 2. Philippine accessions of *G. sepium* more than 2 years old showing branchy characteristic in the germplasm collection trial (Gc 2).

Fig. 3. Foreign accession of *G. sepium* more than 2 years old in the germplasm collection trial (Gs 6).

In terms of mean annual growth/increment, Accession No. VGc 2 showed significant increase in plant height (2.78 m) while Accession No. VGs 6 had significant increase in stem diameter (2.02 cm, dbh) compared to others. If this trend in growth of *G. sepium* appears to be normal then the trees can be harvested in 8-10 years for pulpwood or fuelwood production which could alleviate the dwindling supply of the latter particularly fuelwood.

Accession selection for varietal improvement

The germplasm collection of *G. sepium* is large and perhaps the largest in the country which is feasible for scientific exploration–species trial for fuelwood and pulpwood production, herbage production for fertilizer material (2.19% N; 0.18% P; 2.03% K) as compared to *L. leucocephala* (2.04% N; 0.30% P; 1.04% K) and varietal improvement to produce superior varieties and effectivity as alley cropping with due basis on its plant characteristics such as growth form, leaf size and shape, flowering and fruiting habit and response to rapid propagation techniques.

Soil sampling and analysis

Table 2 shows the initial chemical and textural soil analysis of the experimental area. The soil is a mixture of 13.08% sand, 37.70 % silt and 48.50% clay. The initial chemical analysis showed that N, P, K and Zn are high in the top soil than in the subsoil.

After 3 years of growth of *G. sepium* in the germplasm, soil analysis revealed an increase in nitrogen and potassium content of the soil but decreasing in the amount of phosphorus. The soil has a pH of 5.30 which means it is an ideal for crop production.

Summary and Conclusions

Gliricidia sepium grows well even in very impoverished soil condition. However, planting them directly using either seeds or cuttings in the field, resulted in poor survival rate. To prepare seedlings for outplanting, nursery operations have to be followed. Seedlings raised in the nursery exhibited favorable growing performance particularly those propagated through seeds while those propagated through cuttings somehow had a high mortality rate especially during the long drought that occurred at the early stage of the project.

Several accessions of *G. sepium* had already flowered. However, in the first flowering season, no pods were developed. In the succeeding flowering season, though many pods and seeds had developed, many of the latter were aborted. Pollens were shed off while the flowers were still unopened showing that either the species were cleistogamous or there was a strong self-incompatibility mechanism present.

In terms of plant growth, the test accessions showed promising results. Accession No. VGs 15 (Central America N118, CFI #31/83) grew to the tallest (4.55 m)

Table 2. Soil analysis of the *G. sepium* germplasm collection

Soil samples		*Chemical*				*Textural*			
		%N	*P (ppm)*	*K (me/100 g soil)*	*Zn (ppm)*	*% sand*	*% silt*	*% clay*	*Grade*
A.	Initial								
	Top soil	0.33	3.16	0.38	6.10	C o m p o s i t e			
	Subsoil	0.20	1.76	0.25	5.80	13.80	37.70	48.50	Clay
B.	After 2 years of growth								
	Subsoil	0.34	1.18	1.69	5.30				

and developed the biggest in diameter increment (3.08 cm, dbh) at one year of growth. During the second year of growth, Accession No. VGs 6 (Nicaragua) was noted to be the tallest and had the biggest diameter increment (6.73 m and 4.75 cm, dbh, respectively). Higher increase in mean annual growth based on plant height was noted in Accession No. VGc 2 (Caniaw, Bantay, Ilocos Sur) with 2.78 m and in Accession No. VGs 6 based on diameter (dbh) increment at 2.02 cm.

Acknowledgment

Acknowledgment is due Dr. Rick J. VanDenBeldt of ICRISAT for his assistance extended as NAS Consultant during the framing up for the research proposal and in the implementation of the project; to Mr. Eduardo E. Suan who was the research assistant during the initial stage of the project, for the layout of the experimental field.

Funded by National Academy of Sciences, Committee on Research Grants, Washington, D.C., U.S.A.

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