CANADIAN TREE IMPROVEMENT ASSOCIATION/
ASSOCIATION CANADIENNE POUR L'AMÉLIORATION DES ARBRES

Tree Seed Working Group

NEWS BULLETIN

No. 24, January 1996

A WORD FROM THE CHAIRMAN

The Tree Seed Working Group (TSWG) met during the 25th meeting of the Canadian Tree Improvement Association held in Victoria from August 28 to September 1, 1995. My report will address the highlights of the Working Groups' Workshop and Business Meeting.

A. Biennial Business Meeting

Here are some of the issues dealt with at the meeting:

i) New TSWG Newsletter Editor

As most members are now aware, Hugh Schooley, Editor of the TSWG NewsBulletin since 1985, retired from Forestry Canada in 1995. Hugh was instrumental in developing a sound periodical for tree seed managers and scientists throughout Canada and abroad. His continued support will be deeply missed!

Ron Smith (CFS - Fredericton) has agreed to become our next TSWG NewsBulletin Editor. Moved by Dave Kolotelo, seconded by Howard Frame, that the name of Ron Smith be accepted as the new Editor. Motion carried. Thanks Ron for your support and best of luck!

ii) Internet Discussion Group

In 1994, Hugh Schooley organized a Tree Seed Discussion Group on the Internet (see NewsBulletin No. 21). It is a great way to correspond with colleagues around the world. Ron Smith has accepted to look after the Discussion Group. The move from Petawawa National Forestry Institute (PNFI) to CFS-Maritimes should occur this fall or early winter. All members of the Discussion Group will be informed of the change in due course.

iii) NewsBulletin Production and Mailing Cost

The Petawawa National Forestry Institute (PNFI) has, since 1985, covered the printing and mailing cost of the NewsBulletin. We would like to acknowledge the support over the years. Since PNFI will terminate its mandate as a result of the Federal Government cutbacks, we needed financial support for continuing the publication of the NewsBulletin. Mr. Gerrit van Raalte, Science Director - Forest Resources, CFS-Maritimes, has agreed to take over the cost related to publishing and mailing the NewsBulletin.

iv) TSWG Coordination

Dave Kolotelo, Peter de Groot, and Guy-E. Caron have accepted to continue as Coordinator of the Tree Seed Processing and Testing Working Party, Coordinator of the Cone and Seed Insects Working Party, and Chairman of TSWG, respectively.

v) 1995 TSWG Workshop

Dave Kolotelo coordinated this year's Workshop in Victoria. The Workshop, like the CTIA/ACAA meeting, was well organized and well attended. Dave also organized two tours to the BC Ministry Tree Seed Center in Surrey on August 27 and September 1. Our sincere thanks Dave for your dedication towards the success of the Workshop.

For the first time, the TSWG will have the papers from the presentations refereed. Dr. D.B. Burgess, Co-Editor of the Forestry Chronicle, has agreed to the publication of a Special Issue some time in 1996.

vi) 1996 TSWG Workshop

The TSWG will host another Workshop at the 26th CTIA/ACAA meeting to be held in Quebec City, in 1997. Stephan Mercier, Ministère des Forêts du Québec, will coordinate that workshop and will act as liaison to the organizing committee of the 26th CTIA/ACAA meeting.

vii) Role of CFS in Seed Research

Finally, a short discussion was had on the role of CFS on seed research throughout Canada. Seed research will now be headed by CFS-Maritimes. It is hoped by all, that the National perspective be respected. As Chairman of the TSWG, I will transmit this information to the Administration at CFS-Maritimes.

B. Developments since the TSWG meeting

The 1997 CTIA Executive recently met, and in attendance was Stephan Mercier, our 1996 TSWG Workshop Coordinator. The objective of this first meeting was to make preliminary plans for the upcoming CTIA meeting. As for the TSWG, Stephan is searching for a topic (See the note of Stephan in this NewsBulletin).

I had the opportunity to discuss briefly with Gerrit van Raalte, Program Director, CFS, Fredericton, on the national role of CFS on seed research. Although the idea received attention, it was difficult to address it in depth owing to the many changes now happening at CFS-Maritimes. More to come in the future on this topic!

Finally, don't forget to submit any material of interest to our new Editor Ron Smith. We need more than ever your support in making this NewsBulletin interesting to all to read. Don't forget that our next NewsBulletin publication will be May/June 1996.

Thank you to all!

I hope everyone had a Merry Christmas and I wish you all the best in 1996.

Guy-E. Caron
Chairperson 1991-97

A WORD FROM THE EDITOR

I have to start off my first contribution as the new editor by apologizing for the lateness of this issue. Hopefully some of the growing pains will be eased before the next issue.

I would be remiss if I did not offer my sincere thanks to my predecessor, Hugh Schooley for his yeoman-like efforts over the past ten years. Through his efforts, Hugh molded the Newsletter into an invaluable source of information which has become part of the regular reading for many many forest tree seed researchers and practitioners around the world. This can be attested to by the length of the mailing list!! Thank you again Hugh.

I would hope to, WITH YOUR HELP, continue to keep this Newsletter both interesting and informative. With this in mind, I would like to remind everyone that the Newsletter will be only as good as the readership makes it! Please continue to send in contributions of any kind. This Newsletter is one of the few venues whereby, for example, we on the east coast can find out what our colleagues on the west coast are doing, and vice versa.

Thanks to everyone who sent in information. For those who are sitting on some interesting tidbits, please take a few moments to send them off for inclusion in the next issue slated for May/June.

Ron Smith

Note These Addresses

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Comments, suggestions and contributions for the Newsletter are welcomed by the chairperson, coordinators or the editor.

Update on Internet Discussion Group

As Guy Caron notes in his Chairmans remarks, the server for the TREESEED discussion group on the Internet is being transferred to CFS-Maritimes and will eventually be coordinated by myself. The actual transfer has not yet been done, but we hope to have it completed some time this winter. When this is done, I will be sure to send a message with any pertinent changes to all who have subscribed. In the interim, you can still send messages over the net as per normal. If you have any specific requests, please feel free to contact me directly at the email address provided.

Ron Smith

Poor Seed Production?

The 1994 collection of seed from the Cooperative loblolly pine seed orchards was the lowest in 15 years. There were ONLY 15.6 tons of seed collected; the previous low was the 1980 crop of 7.9 tons of seed. The two main causes of the low harvest were the surplus of seed on hand and the 'storm of the century in the spring of 1993 when many of the orchard flower crops were damaged by cold and snow. Second generation orchards are now meting approximately 40% of the seed requirements.

[Extracted from the 39th Annual Report of the North Carolina State University-Industry Cooperative tree Improvement Program p. 16-17].

Book Review

Seeds of Woody Plants in North America. Revised and Enlarged Edition by J.A. Young and C.G. Young, Dioscorides Press, 1992. 418 p.

This book is the awaited revised and enlarged edition of Schopmeyer's 1974 classic, Seeds of Woody Plants in the United States (U.S. Dept. Agric. Handbk. 450). It has been expanded to include genera from all over North America(386 genera in all), but the expansion has been at the expense of the introductory chapters and some taxonomic detail(but as noted, this other information can be easily obtained elsewhere).

Each genus is treated in its own chapter under the headings of "Growth, Habitat, Occurrence and Use", "Flowering and Fruiting", "Collection, Extraction and Storage of Seeds", "Pregermination Treatment", "Germination", and "Nursery and Field Practices".

Barbara Booth points out a couple of errors in the manual, but notes that it is both thorough and easy to use, and highly recommends the volume to anyone dealing with seed germination or identification.

Address of Publisher:
Dioscorides Press (Timber Press Inc.)
9999 S.W. Wilshire, Suite 124
Portland Oregon
USA 97225

[The above excerpts were from a review by Barbara Booth, Dept. Botany, University of Guelph that appeared in the Canadian Botanical Association Bulletin 28(4)].

Newsletters

Below are the names and contacts for Newsletters which might interest some of our readers:

Dendrome

This is an interesting newsletter reporting on all aspects of tree genome research. Write to:

Dendrome
800 Buchanan Street
U.S. Forest Service
Albany, CA, 94710

Seed and Seedling Extension Topics

Write to:
Eric van Steenis
Seed & Seedling Extension Topics
B.C. Ministry of Forests
Nursery Extension Services
4275 - 96th Ave.
Surrey B.C.
Canada V3V 7Z2

(Note the following article in vol. 8(1), Summer, 1995 by Joe Webber, pp 11-12). **Alternate Orchard Design for Coastal Douglas-fir, An Approach for Improving genetic Efficiency.**

Upcoming Meetings

Tree Improvement for Sustainable Tropical Forestry
Caloundra, Queensland, Australia
Oct. 27-Nov. 2, 1996
Sponsored by Queensland Forest Research Institute and IUFRO
Contact: Stephen Walker
MS 483, Gympie, Queensland.
4570,Australia
Tel:National:(074)822244
International:+61 74 822244
Fax:National:(074)828755
International +61 74 828755
email: stevew@qfri.fh.dpi.qld.gov.au

International Symposium on In Situ Conservation of Plant Genetic Diversity
Sponsored by the Global Environmental Trust Fund and the Turkish Ministries of Agriculture and Rural Affairs, Forestry, and Environment
Contact; Nusret Zencirci
Central Research for Field Crops
PO Box 226
06042 Ulus,
Ankara, Turkey
Tel: 90-312-287-89-57
Fax: 90-312-287-89-58

Seed Pathology Meeting
Autumn, 1996
Czech Republic
Contact: Jack Sutherland
Pacific Forestry Centre
506 West Burnside Rd.
Victoria, B.C.
V8Z 1M5
Fax:(506)363-0775
Email:jsutherland@a1.pfe.forestry.ca

IUFRO Working Party:S2.07-01
Cone and Seed Insects Meeting
2-9 September 1996
Alpine Ecology Centre of
Monte Bondone
Contact: Dr. Andrea Battisti
(Further details will be provided as they become available)

The Announcement for your upcoming meeting could have been here!

Biology and Control of Reproductive Processes in Forest Trees. Tree Physiology 15 (7/8):419-557. [Eds.] J.E. Webber, J.N. Owens, and M.U. Stoehr.

In August 1993, the IUFRO Working party on Reproductive Processes hosted a symposium in Victoria, B.C. A number of the papers presented at this symposium were published in a special edition of the Journal Tree Physiology. The papers in this issue represent the most current findings in the biology and physiology of tree (albeit mostly conifer) reproduction and is a MUST HAVE for anyone doing research in tree reproduction. The list of papers and authors are given below:

From flower induction to seed production in forest tree orchards (M. Bonnet-Masimbert, J.E. Webber, 419-426 pp).

Effects of irrigation, spacing and fertilization on flowering and growth in young Alnus rubra. (Constance A. Harrington, Dean S. Debell. 427-432 pp).

Juvenility and maturation in conifers: current concepts. (Micheal S. Greenwood. 433-438 pp).

Sexual expression in container-grown jack-pine seedlings. (W.H. Fogal, S.M. Lopushanski, S.J. Coleman, H.O. Schooley, M.S. Wolynetz. 439-442 pp).

Nuclear and cytoplasmic changes associated with maturation in the vascular cambium of Larix laricina. (E.J. Mellerowicz, R.T. Riding, M.S. Greenwood. 443-450 pp).

Transport and metabolism of gibberellins in relation to flower bud differentiation in Norway spruce (Picea abies). (Per Christer Odén, Quig Wang, Karl-Anders Högberg, Martin Werner. 451-456 pp).

Effects of gibberellin $A_{4/7}$, root pruning and cytokinins on seed and pollen cone production in black spruce (*Picea mariana*). (Ron Smith and Micheal S. Greenwood. 457-466 pp).

Flowering on long and short shoots of Larix laricina in response to differential timing of $GA_{4/7}$ applications. (Throstur Eysteinsson, Micheal S. Greenwood. 467-470 pp).

Influences of crown size and maturation on flower production and sex expression in Picea glauce treated with gibberellin $A_{4/7}$. (Gaétan Daoust, Ariane Plourde, Jean Beaulieu. 471-476 pp).

Constraints to seed production: temperate and tropical forest trees. (J.N. Owens. 477-484 pp).

Abscisic acid and zygotic embryogenesis in Pinus taeda. (Rene H. Kapik, Ronald J. Dinus, Jeffery F.D. Dean. 485-490 pp).

The role of acrotony in reproductive development in Picea. (G.R. Powell. 491-498 pp).

Phenological measurements of microsporogenesis in trees. (Alpo J. Luomajoki. 499-506 pp).

Pollen management for intensive seed orchard production. (Joe E. Webber. 507-514 pp).

Viability and seasonal distribution of Scots pine pollen in Finland. (P. Pulkkinen, A. Rantio-Lehtimäki. 515-518 pp).

Effects of supplemental mass pollination (SMP) in a young and a mature seed orchard of Pinus sylvestris. (U. Eriksson, G Jansson, R Yazdani, L. Wilhelmsson. 519-526 pp).

Seed orchards in development. (G.B. Sweet. 527-530 pp).

Surrogate pollen induction shortens the breeding cycle in loblolly pine. (D.L. (Bramlett, C.G. Williams, L.C. Burris. 531-536 pp).

Genetic and environmental variation of foliar nutrient concentrations and strobilus initiation in fertilized loblolly pine seed orchards ramets. (R.C. Schmidtling. 537-544 pp).

Evaluation of the tree-improvement delivery system: factors affecting genetic potential. (Y.A. El-Kassaby. 545-550 pp).

Sexual reproduction in a greenhouse and reduced autumn frost hardiness of Picea abies progenies. (Øystein Johnsen, Tore Skrøppa, Gunnar Haug, Inger Apeland, Geir Østreng. 551-556 pp).

Special article

Pinching - A Crown Management Tool in Jack Pine Seed Orchards

Introduction

The general strategy in managing tree crowns is to maintain and enhance ground access to the cones restricting the development of a vertical crown in favor of one that is laterally oriented. Restricting height growth must not come at the expense of cone production capacity to the point where cone collection targets are affected. The following is a condensed report describing the tactical use of 'pinching' as a crown management tool in a jack pine seedling seed orchard at Ramore Ontario.

Pinching Defined

Pinching has its origins in the gardening trade whereby current or new growth at the tips of branches is literally 'pinched' off to stop growth in that area temporarily. In the case of jack pine shoots, this new growth is rather difficult to physically pinch, so an appropriate pruning knife is used. While `cutting' has an effect on growth similar to true `pinching', there are other considerations for applying the technique,

Objectives

Removing any amount of crown has the potential to reduce cone production. Pinching, if done correctly, i.e., selectively and judiciously, has the least initial impact in terms of removing existing flower sites. At the same time, this loss is mitigated somewhat by providing the potential for increased shoot and flower site development from buds forming at or near the cut face of the original shoot.

Pinching can be used as a follow-up treatment to conventional topping. Pinching selected branches after the more severe topping can reduce the hyponastic response (the speed with which residual branches replace the removed leaders).

As previously mentioned the growth of the treated shoot will be temporarily stopped. In response to this, nearby higher order laterals will themselves increase in vigor, essentially providing greater potential for flowering while restricting branch length and increasing crown density.

Tactical Considerations

In order to foster prolific shoot development we must first promote the development of buds at or near the cut face of a pinched shoot.

Two obvious factors which interact in determining the number of buds developing are (1) timing and location of the cut as it relates to the progress of shoot elongation and development, and (2) the diameter (O.D.) of the shoot at the cut face.

I have established a timing reference point called 'Max Sex'. This refers to a point in the phenology of seed cone development, i.e., when the majority of seed cones are fully receptive with cone scales fully reflexed. It may be necessary to not carry out crown management work which removes seed cones until after Max Sex since seed yield impact studies may be required to determine the effects on cone collection targets - this can only be done if all seed cones have emerged. Such a study could be carried out at Max Sex or a few calendar days after.

The location of the cut along the elongating shoot should generally be consistent even though there is variability in the physiology of development between shoots and trees. This location reflects favorable shoot diameter/bud correlation, reasonable branch length reduction, and inherent sterile zones along the shoot. Most new buds originate from within the fascicle of 2 needles wrapped in papery bud scales - there are predetermined areas along the shoot which bear no needles and therefore little potential for bud development. Therefore, I prefer to pinch at a point which is just below the first internodal branching and above the plane created by the tips of those basal lateral shoots in the same whorl.

I have chosen an average target of 3 buds or more per pinched shoot. Trial data has shown that both timing and shoot diameter interact to provide operational guidelines which ensure realization of the 3-bud per shoot target. In general, the later after `Max Sex' that you do the pinching, the fewer the numbers of buds that will be produced and develop on the shoots (Figure 1).

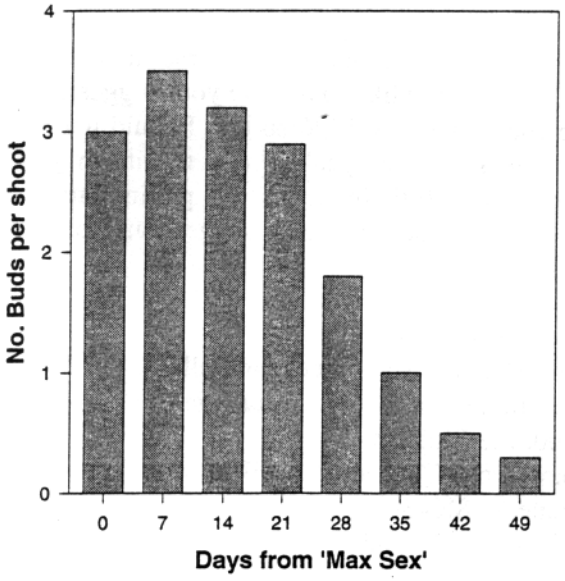

Figure 1. Mean numbers of buds produced per shoot by time of pinching.

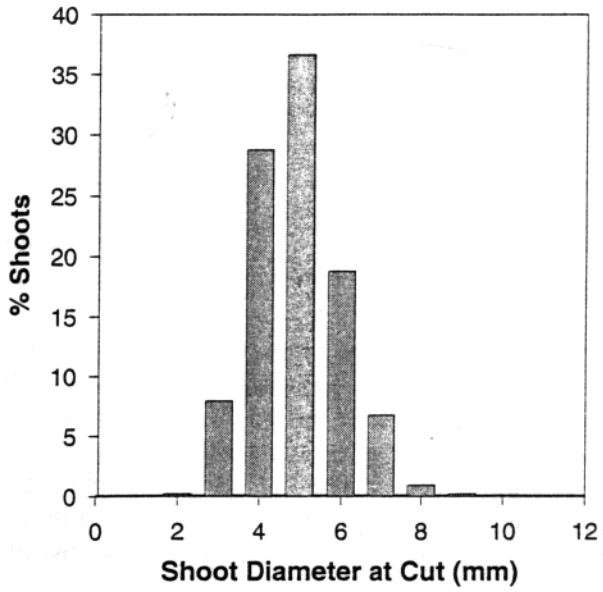

Figure 2. Percentage of shoots by diameter class in the study.

The numbers of buds produced following pinching depended on both shoot diameter and the time of pinching. On shoots with diameters down to 4 mm, pinching could be done up to 14 days after Max Sex and still result in good bud production. However, as pinching was delayed, bud production diminished first on the smallest shoots, and then progressively so with increasing shoot diameters. Bud production was minimal if pinching was done later than Max Sex plus 35 days.

Therefore, to determine when best to pinch, we must not only consider shoot diameters but also their frequencies. When shoot diameter frequency is considered together with the timing/diameter dependent success threshold, it becomes obvious that at a certain point in time we become limited to shoots with larger diameters; which occur with the least frequency. In the field we would end up spending most of our time searching for those elite diameters rather than doing any pinching. The shoots pinched in my study were randomly selected from areas throughout individual crowns where pinching might typically be carried out. The distribution of shoot diameters in this study follow a typical bell curve (Figure 2).

Operational Procedure

1. At Max Sex or within a few days after, estimate how many first-year flowers will be removed (this is your impact study). The numbers of flowers to be removed by pinching HAS TO BE acceptable to you. Be selective and judicious in how many shoots per tree are pinched.

2. Using the impact study as a guide, the numbers of shoots to be pinched per tree and the amount of the orchard to be treated is determined.

3. Be consistent with the location of the pinch along the shoot.

4. Utilize the most efficient window of time in order to maintain a minimum 3-bud per shoot threshold; the recommended window for my orchard is as follows:

   Max Sex + 4 days* to Max Sex + 14 days; a 10 day window - this allows for a wide range of shoot diameters, down to 4 mm at +7 days then down to 5 mm at + 14 days, to be utilized.

   * the 4 days after Max Sex allows you to do the potential assessment,

5. The network of shoots developing from pinching will take from 2 to 4 growing seasons to provide flowering sites - so incorporate this time frame into your strategy, i.e., don't remove this network of shoots in subsequent cuts before they deliver the goods.

To date I have carried out one, rather limited application at an operational scale to evaluate productivity. Early results show that with a range of 2 - 8 cuts (pinches) per tree, approximately 100 trees can be treated in one working hour. This technique is under development, so it is important to remember I am continuing to develop and assess the technique as to its applicability under existing program and orchard management strategies. If you are interested in further details on this work or have any suggestions, please contact me at:

Ministry of Natural Resources
896 Riverside Dr.
Timmins, Ont., P4N 3W2
phone(705)267-7951 Fax(705)360-2022.

[submitted by Chris Atack]

1997 Meeting of the Tree Seed Working Group

It seems like the CTIA meeting in Victoria last August was barely over when it came time to start preparations for our next session; in 1997 in Quebec City. The theme for the Symposium has not been finalized, but will most likely relate to the socio-economic impacts of tree improvement practices using results obtained in recent years. The organizing committee for the 26th meeting of the CTIA/ACAA is comprised of:

Chairman: Michel Villeneuve, Quebec Ministry of Natural Resources
Vice-chairman local arrangements: Jean Bousquet, University of Laval
Vice-chairman symposium: Jean Beaulieu, CFS-Quebec
Secretary: Ariane Plourde, CFS-Quebec

I have the pleasure of having been appointed Chairman of the Tree Seed Working Group for the next workshop. I am looking for a theme for this next meeting. Correspondingly, I would appreciate receiving your comments or suggestions. I need your input if we are to prepare a program for the workshop that meets the needs of the majority of the members of the TSWG. I would like to receive your suggestions before the end of January 1996 so that I could undertake the first steps to find speakers and to inform you in the next News Bulletin about the preliminaries of this meeting. Please send any suggestions to me at the address below.

Stéphan Mercier
Ministère des Ressources naturelles
Direction de la recherche forestière
2700, rue Einstein
Sainte-Foy (Quebec) G1P 3W8
Phone:(418)643-7994
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News from the Weyerhaeuser Seed Orchard, Prince Albert, Saskatchewan

Jack Pine Seed Orchard

Seed production from our jack pine clonal orchard has been increasing steadily since 1989 (see Figure 1). The orchard is now producing sufficient quantities of seed to meet Weyerhaeuser 's reforestation needs.

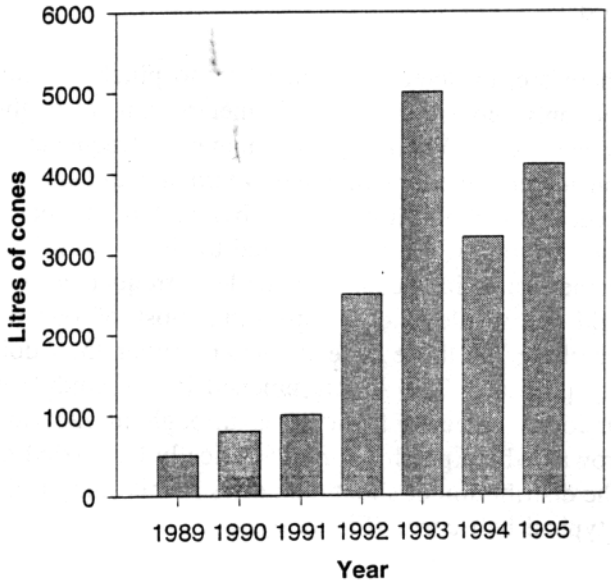

Figure 1. Summary of jack pine cone production in the Weyerhaeuser seed orchard.

As our orchard trees continuously get taller there is an increasing concern for the safety of the workers as they have to use progressively taller ladders to pick cones. To address this concern, two custom designed step ladders were built (Figure 2). that are 12 and 14 feet tall respectively, and have quick attachments to mount on a trailer which makes them very stable.

The trailers can be manually pushed or pulled, or towed behind an ATV. The ladders are equipped with a guard ring at the top to help prevent the picker from falling. The ladders are fastened on the trailer so that the back side is straight up and down, allowing the pickers to get close to the tree trunk for easy access to the cones. The trailer for the 14 foot ladder has extensions to the platform that when pulled-out extend the trailer to platform to 8 feet, further increasing its stability (especially useful on windy days). We have recently purchased an aerial lift for use with the 1996 cone crop.

Figure 2. Photograph of the trailer-mounted ladder.

In 1996, we will be doing a light, initial roguing by removing two clones, the progeny from which are doing poorer than the "checks" in the progeny tests. Cones form these two clones were not picked in 1995.

A lot of time has been spent in the last two years measuring and rating trees in 26 jack pine open-pollinated progeny tests ranging in age from 10 to 13 years. Selections from the tests have now been made and will be used in an advanced generation breeding program.

White Spruce Seed Orchard

This year marked the completion of the white spruce controlled pollination program in the orchard, and in 1996, our last first-generation progeny test will be seeded in the greenhouse. Unfortunately, Cone production from our white spruce orchard has been somewhat disappointing. Advice on this matter would be appreciated (Please call Louise at (306)922-8440).

Aspen Program

An aspen provenance test will be established at our orchard site. In addition to seed from our own plus-trees (selected in our FMLA), seed for the test will be obtained from three regions in Alberta, western Saskatchewan, and Minnesota. The information from this provenance test will help us in the future should we decide to start an active aspen improvement program.

[submitted by Lousie Corriveau]

New Members

S. Sola Ajayi
Dept. Plant Science
Obafemi Awolowo University
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Iskander Siregar
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Fakultas Kehutanan
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P6B 3E1

Harry O. Yates III
265 Gentry Drive
Athens, Georgia
U.S.A. 30605-3923

Recent Publications

Requests of reprints of the following publications should be sent to the respective authors.

Bowes, D.C. and D.J. Kelly, 1994. relative abundance of red squirrels in central New Brunswick. Univ. New Brunswick, undergraduate thesis.

Byram, T.D., and W.J. Lowe, 1994. Forty-second Progress Report of the Cooperative Forest Tree Improvement Program, Texas Forest service, Circular 294, 27p.

Caron, G.E., 1995. Seed-cone and pollen-cone production models for young black spruce seedling seed orchards: a first approximation. Can. J. Res. 25: 921-928.

Caron, G.E. and R.A.Fleming, 1995. A simple method for estimating the number of seed cones on individual black spruce. Can. J. For. Res. 25:398-406.

Caron, G.-E., S. Mercier and A. Rainville. 1994. White spruce pollen dispersal near an orchard with a large pollen dilution zone. X Simposio de Palinologia (APLE) Valencia:pp. 293-305.

Hodge, G., T. White, G. Powell, and D. Rockwood, 1995. Thirty-seventh Annual Progress report of the Cooperative Forest Genetics Research Program, School of Forest Resources and Conservation, Instit. Food & Agric. Sci., Univ. Florida, 55p.

Mercier, S., 1995. In situ forcing of pollen maturation in Jack pine and Japanese larch male cones. New Forest 9:261-272.

Mercier, S., 1995. Extraction des graines de pin rouge à l'aide d'un traitement de congélation. Ministère des Ressources naturelles. Direction de la recherche forestière. Service de l'amélioration des arbres. Note de recherche n° 62, 8p.

Mercier, S., A. Raineville, and G.-É. Caron, 1994. Contamination pollinique potentielle de quatre vergers à graines au Québec. Ministère des Ressources naturelles. Direction de la recherche forestière. Service de l'amélioration des arbres. Mémoire de recherche n°. 113,, 78p.

Piotto, B. 1994. Effects of temperature on germination of stratified seeds of three ash species. Seed Sci. & Technol. 22:519-529.

Simpson, J.D. 1995. Thirteenth Annual Report of the New Brunswick tree Improvement Council. Produced by the Can. For. Serv.-Maritimes, 27p.

Smith, R.F., and L. D. Yeates 1995. Proceedings of the Eighth Maritime Seed Orchard Managers Workshop. Oct. 1994. 54p.

Tousignant, D., M. Villeneuve, M. Rioux, and S. Mercier, 1995. Effect of tree flowering and crown position on rooting success of cuttings from 9-year-old black spruce of seedling origin. Can. J. For. Res. 25:1058-1063.

Veilleux, L. and S. Mercier. 1994. Maturation des graines de l'épinette blanche à partir du suivi systématique de 16 acides aminés libres. Ministère des Ressources naturelles. Direction de la recherche forestière. Service de l'amélioration des arbres. Note de recherche n° 61. 11p.