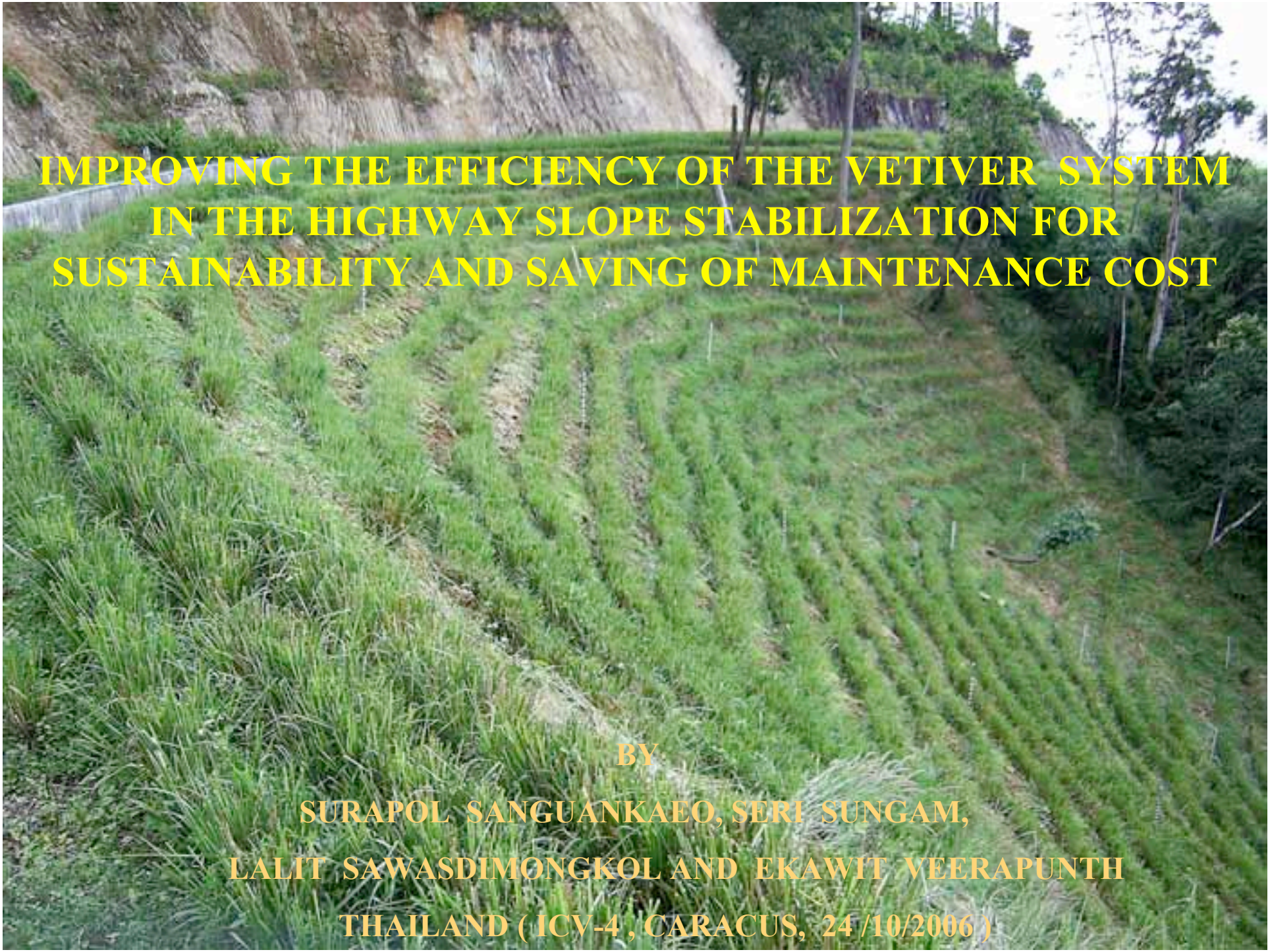

IMPROVING THE EFFICIENCY OF THE VETIVER SYSTEM IN THE HIGHWAY SLOPE STABILIZATION FOR SUSTAINABILITY AND SAVING OF MAINTENANCE COST

BY

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LALIT SAWASDIMONGKOL AND EKAWIT VEERAPUNTH

THAILAND (ICV-4 , CARACUS, 24 /10/2006)

1) BACKGROUND OF THE VETIVER GRASSING PROJECT OF THE HIGHWAYS DEPARTMENT, THAILAND

1.1 VETIVER SYSTEM FOR HIGHWAY CONSTRUCTION PROJECT

VS FOR EROSION CONTROL AND STABILIZED DEEP CUT AND HIGH FILL SLOPE

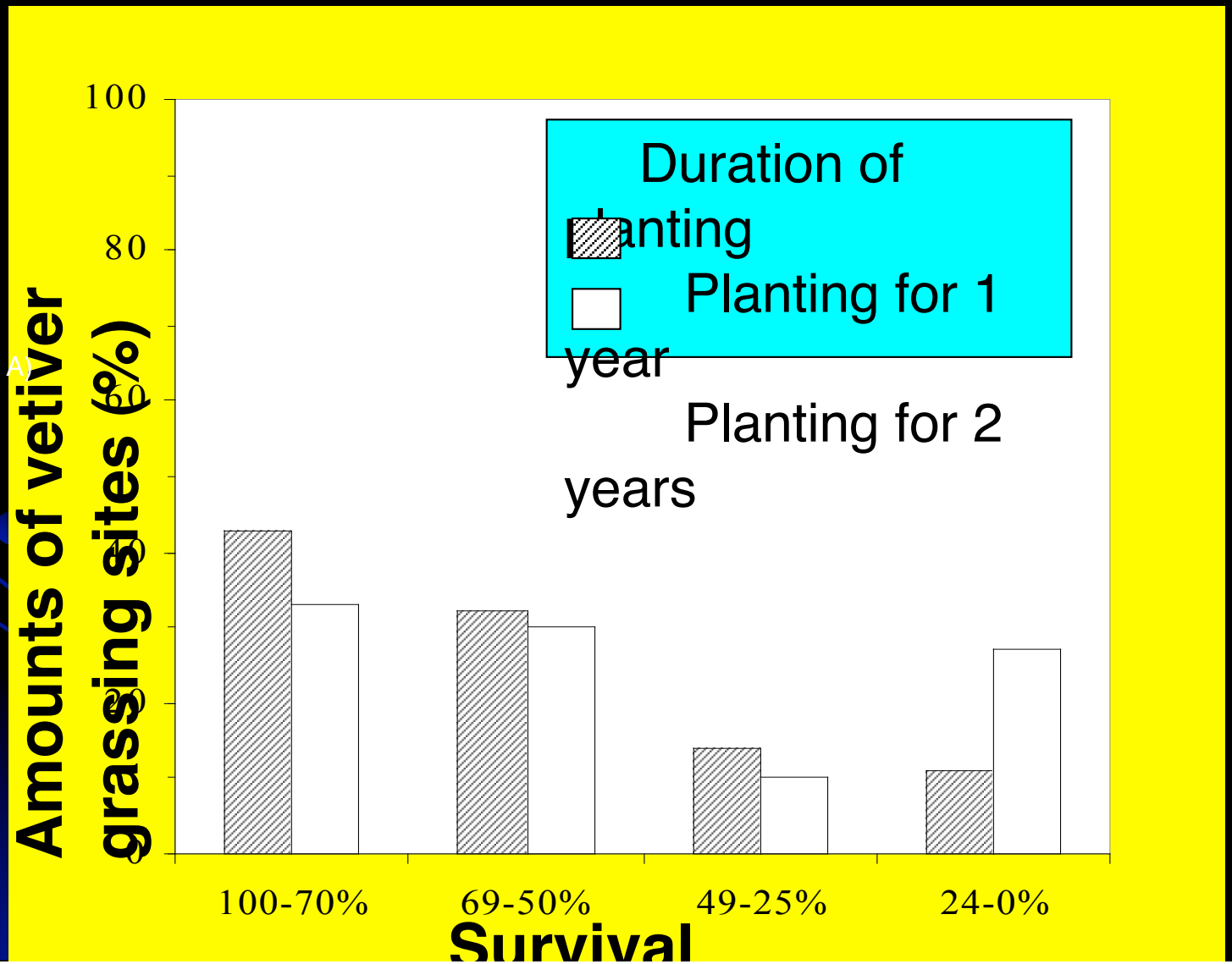
1) BACKGROUND OF THE VETIVER GRASSING PROJECT OF THE HIGHWAYS DEPARTMENT, THAILAND

1.2 VETIVER SYSTEM FOR HIGHWAY MAINTENANCE

IN REHABILITATION OF COLLAPSED EMBANKMENT SLOPE

2) SITUATION AND PROBLEMS IN THE VETIVER GRASS PROJECTS

2.1 UNSUSTAINABILITY OF VETIVER SYSTEM



2) SITUATION AND PROBLEMS IN THE VETIVER GRASS PROJECTS

2.1 UNSUSTAINABILITY OF VETIVER SYSTEM

2) SITUATION AND PROBLEMS IN THE VETIVER GRASS PROJECTS

MAINTENANCE FOR 1-2 YEARS AFTER PLANTING (WEEDS CONTROL)

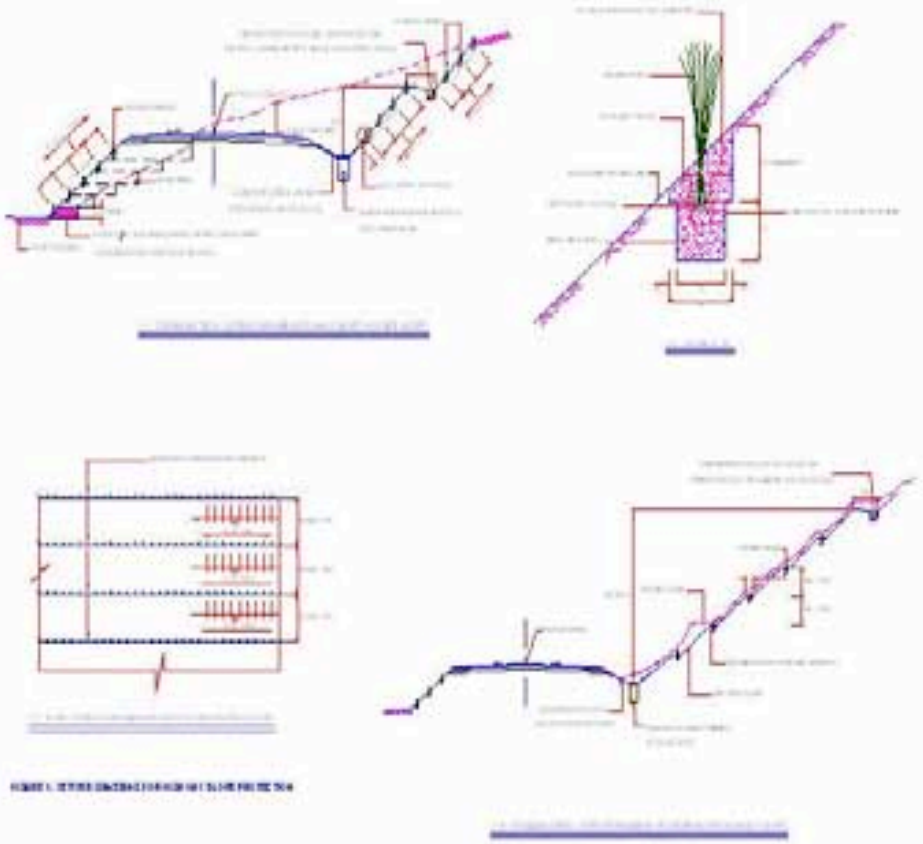
2) SITUATION AND PROBLEMS IN THE VETIVER GRASS PROJECTS

MAINTENANCE FOR 1-2 YEARS AFTER PLANTING (FERTILIZATION)

2) SITUATION AND PROBLEMS IN THE VETIVER GRASS PROJECTS

2.2 EXISTING STANDARD DRAWING (SP-206, SP-205/1 :1999)

VETIVER GRASSING FOR HIGHWAY SLOPE PROTECTION SP-206(REVISION) 1999



THE TYPICAL DRAWING SHOWS THE METHOD OF VETIVER GRASS PLANTING ON BACK SLOPE AND SIDE SLOPE OF HIGHWAYS

3) EXPERIMENTAL STUDY (HIGHWAYS ROUTE NO. 3272 , KANCHANABURI PROVINCE, THAILAND: 2003 – 2006)

3.1 TO STUDY THE OPTIMUM PLANTING TECHNIQUES AND MAINTENANCE COST

EXPERIMENTAL DESIGN

S1 = SOIL FERTILITY IMPROVEMENT AND MAINTENANCE FOR 2 YEARS

S2 = SOIL FERTILITY IMPROVEMENT

S3 = CONTROL

3) EXPERIMENTAL STUDY

3.2) TO STUDY THE EFFICIENCY OF *ARACHIS ' PINTOI '* TO CONTROL WEEDS

VETIVER INTERPLANTING WITH *Arachis pintoi* (LEGUMINOUS PLANTS

SPACING OF ' *PINTO*' WERE 25X25 CM. AND 15X15 CM.

LEGUMINOSAE

(CREEPING FORAGE PEANUT)

- MAT-FORMING PERENNIAL (TO PREVENT OR CONTROL WEEDS)

- BIOLOGICAL NITROGEN FIXATION (TO FERTILE SOIL)


‘ PINTOI ‘ IS A CREEPER THAT GROWS CLOSELY TO
THE GROUND SURFACE AND SHADE TOLERANT CAN
GROW WITH TALL GRASS (VETIVER)

4) RESULTS AND CONCLUSIONS

4) RESULTS AND CONCLUSIONS

4.1 MAINTENANCE OF WEED AND FERTILIZATION ARE NECESSARY FOR 1-2 YEARS AFTER PLANTING

EXPERIMENTAL PLOT (S3): VETIVER PLANTING FOR 2 YEARS (AUGUST,04 – JULY, 06)

4) RESULTS AND CONCLUSIONS

4.2 OPTIMUM PLANTING TECHNIQUES

SUITABLE VETIVER TILLERS

NURSERY VETIVER SLIPS IN POLY-BAGGED FOR 45-60 DAYS TO PRODUCE ACTIVE TILLERS

SITE: BAN RAI – PILOK (KANCHANABURI PROVINCE , THAILAND)
JUNE , 2005

4) RESULTS AND CONCLUSIONS

4.2 OPTIMUM PLANTING TECHNIQUES

SUITABLE VETIVER TILLERS

ACTIVE TILLERS AT AGE OF 45-60 DAYS MUST BE PLANTED

4) RESULTS AND CONCLUSIONS

4.2 OPTIMUM PLANTING TECHNIQUES

SOIL FERTILITY IMPROVEMENT: FERTILIZE THE SOIL WITH BASAL APPLICATION OF CHICKEN MANURE OR FARMYARD MANURE WITH CHEMICAL FERTLIZERS

4) RESULTS AND CONCLUSIONS

4.2 OPTIMUM PLANTING TECHNIQUES

PLANTING DURING SUITABLE PERIOD (AT LEAST 2 MONTHS FOR GROWING IN RAINY SEASON)

4) RESULTS AND CONCLUSIONS

4.3 EFFECT OF SLOPE INCLINATION ON THE GROWTH DEVELOPMENT

4) RESULTS AND CONCLUSIONS

4.4 EFFICIENCY OF EROSION CONTROL AND STABILIZATION OF HIGHWAY SLOPES

BEFORE STABILIZED BY VETIVER (IN 2003)

AFTER STABILIZED BY VETIVER FOR 2 YEARS

4) RESULTS AND CONCLUSIONS

4.5 UNIT RATES OF VETIVER GRASSING FOR HIGHWAY SLOPE PROTECTION

A)	GROUND PREPARATION COST	0.18 BAHT/ TILLER
B)	MATERIALS COSTS	1.10 BAHT/ TILLER
	- MATERIALS FOR MULTIPLICATION IN PLASTIC BAGS	
	- COST OF VETIVER TILLER	
	- MATERIALS FOR BASAL APPLICATION	
	- MATERIAL FOR MAINTENANCE	
C)	LABOUR COSTS	1.50 BAHT/ TILLER
	- LABOUR COST OF NURSERY FOR 60 DAYS	
	- LABOUR COST FOR PLANTING AT THE TARGET AREA	
D)	TRANSPORTATION COSTS	0.55 BAHT/ TILLER
	- IN CASE OF BARE ROOT SLIPS	
	- IN CASE OF TILLER IN PLASTIC BAG	
	- FROM NURSERY TO TARGET AREA	
E)	MAINTENANCE COST AFTER PLANTING	0.50 BAHT/ TILLER
F)	MISCELLANEOUS COST	0.25 BAHT/ TILLER
	TOTAL COST	4.00 BAHT/TILLER

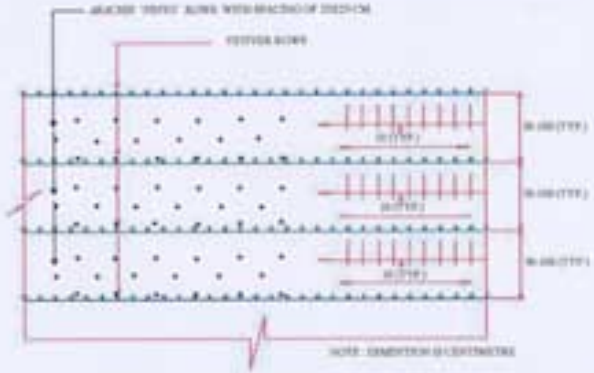
4) RESULTS AND CONCLUSIONS

4.6 REVISED DRAWING BASED ON TECHNOLOGY IMPROVEMENTS : VETIVER GRASS PLANTING FOR HIGHWAYS SLOPE PROTECTION, SP- 205 / 2 (2006)

Fig.18 Standard Drawing "Vetiver grass planting for highways slope protection" (2006)

- Spacing of vetiver grass rows varies from 50-100 cm. and in clump 10 cm. which depend on severe erosion problems on soils.
- Drainage system i.e. interceptor ditch, drain chute, subdrains are also necessary.

Fig.18.1 Cross-section : Vetiver grassing on back slope and side slope

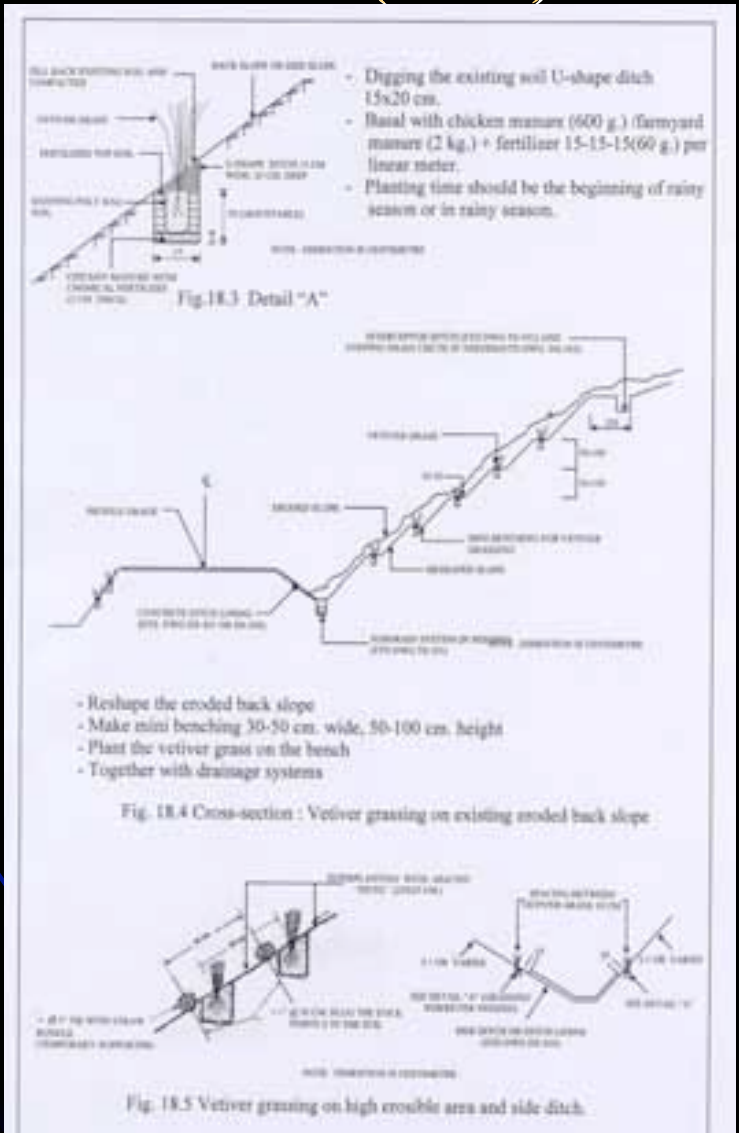


- For not serious cases, planting in rows is 1.00 m. apart and in clump 10 cm spacing.
- For serious cases, planting in rows is 50 cm. apart and in clump 10 cm spacing.
- For minimal maintenance of weeds and fertilization, *Arachis* 'Pinto' is planted between the rows of vetiver.

Fig. 18.2 Plan : Vetiver grassing on back slope and side slope

4) RESULTS AND CONCLUSIONS

4.6 REVISED DRAWING BASED ON TECHNOLOGY IMPROVEMENTS : VETIVER GRASS PLANTING FOR HIGHWAYS SLOPE PROTECTION, SP- 205 / 2 (2006)



4) RESULTS AND CONCLUSIONS

4.6 REVISED DRAWING BASED ON TECHNOLOGY IMPROVEMENTS : VETIVER GRASS PLANTING FOR HIGHWAYS SLOPE PROTECTION, SP- 205 / 2 (2006)

1) THE SPECIFICATION OF VETIVER TILLER

2) GROUND PREPARATION AND HOLE DIGGING

3) SOIL FERTILITY IMPROVEMENT

4) PATTERN OF VETIVER GRASSING

5) SUITABLE PERIOD FOR PLANTING

6) PLANT CARING

7) MAINTENANCE AFTER PLANTING

8) MINIMAL MAINTENANCE (THE VETIVER IN COMBINATION WITH *ARACHIS 'PINTOI'*)

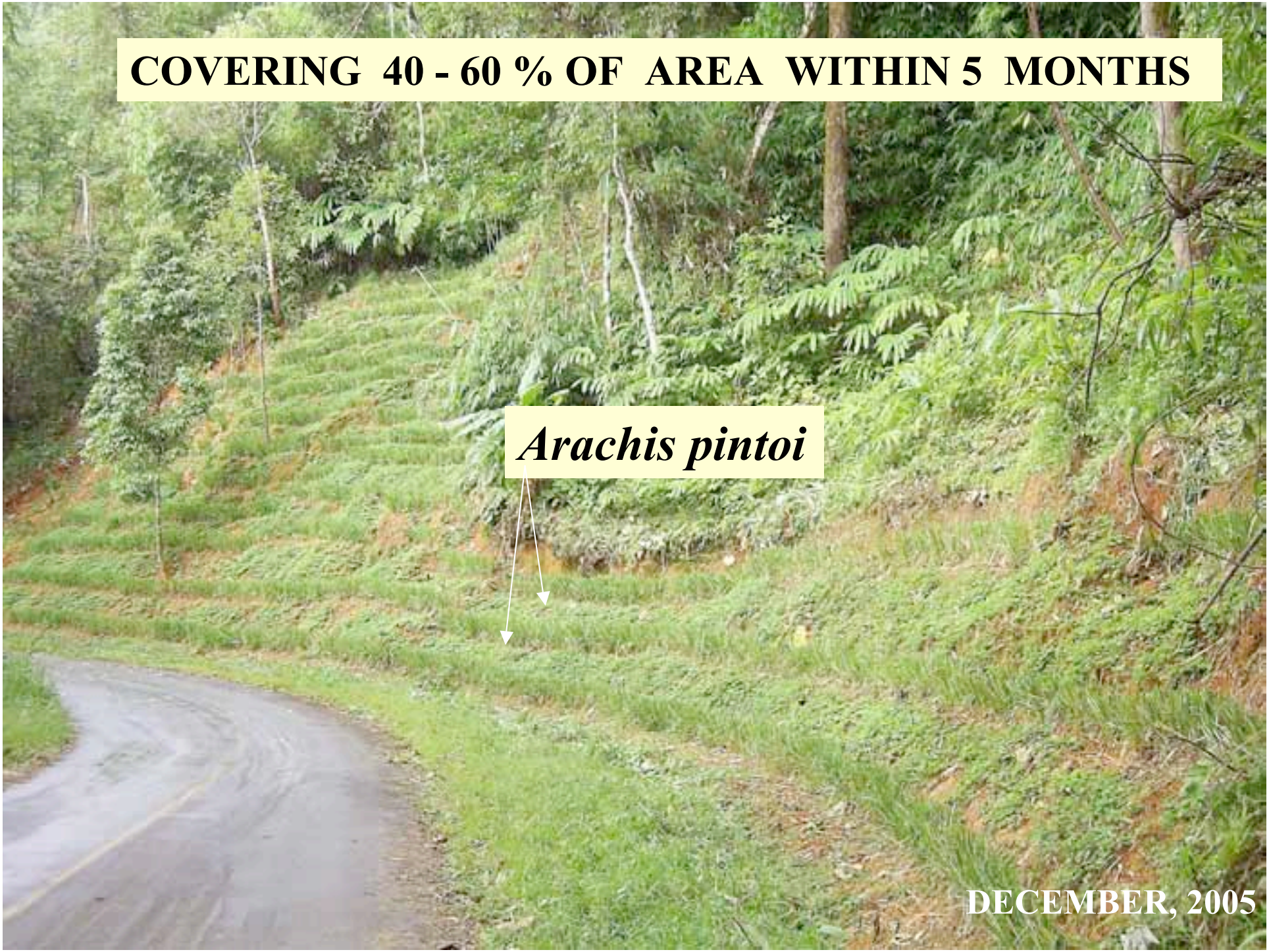
9) VETIVER GRASSING ON DEEP CUT AND HIGH FILL SLOPES

4) RESULTS AND CONCLUSIONS

4.7 COVERING OF *Arachis pintoi* TO CONTROL WEEDS

COVERING 30 - 40 % OF AREA WITHIN 3 - 4 MONTHS (SPACING 25X25 CM.)

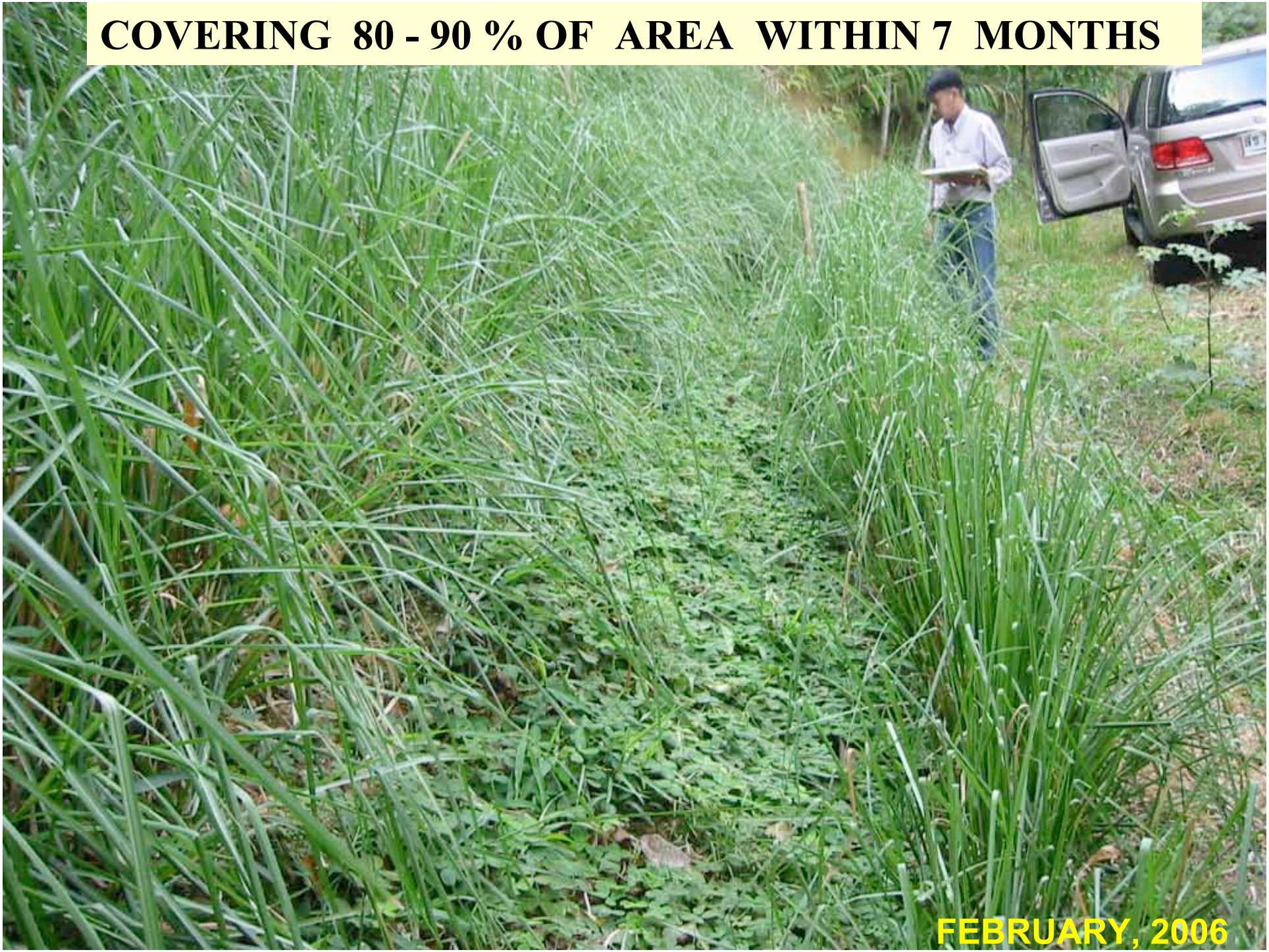
COVERING 50 - 60 % OF AREA WITHIN 3 - 4 MONTHS (SPACING 10X10 CM.)


COVERING 40 - 60 % OF AREA WITHIN 5 MONTHS
Arachis pintoi
DECEMBER, 2005

COVERING 40 - 60 % OF AREA WITHIN 5 MONTHS

COVERING 50- 70 % OF AREA WITHIN 7 MONTHS

COVERING 80 - 90 % OF AREA WITHIN 7 MONTHS



VERY DENSE MAT-FORMING (HIGH EFFICENCY ON CONTROLING WEEDS)

COVERING 80 - 90 % OF AREA WITHIN 12 MONTHS


1 YEAR : AUGUST, 2006


1 YEAR: AUGUST, 2006