Performance of four European hemp cultivars cultivated under different agronomic experimental conditions in the Eastern Cape Province, South Africa

Abstract No:

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Abstract

The purpose of this work was to obtain information on the performance of four European hemp cultivars piloted at five different sites in the Eastern Cape (South Africa), by assessing the fibre content of each cultivar grown under different agronomic experimental design. The southern region of the Eastern Cape is characterized by long day-length periods compared to other areas and it can be an ideal area suited for hemp cultivation in South Africa.

According to the objectives of the project work plan, selected hemp straw samples from the four hemp pilot sites were investigated to determine the hemp fibre content. The experimental results gave information about the fibre content in general and in accordance to the agricultural parameters as documented in the report on "Hemp cultivar adaptation trials in the Eastern Cape" by the Agriculture Research Council – Institute for Industrial Crops, the ARC-IIC, as well as an indication of the best performing cultivars of the four piloted in the Eastern Cape Province.

After dew retting the hemp fibre was extracted from the stems using a simple and relatively inexpensive decorticating turbine.

For each hemp cultivar piloted, the fibre content was objectively evaluated in terms of both the long and short fibres. The relationships between the fibre content of the European hemp cultivars piloted vis-à-vis the agronomic experimental design were evaluated and used to identify the performance of individual cultivar and thus its adaptation to the Eastern Cape conditions.

Keywords: European hemp cultivars; decortication; fibre content.

1 INTRODUCTION

South Africa has a very high level of unemployment, hovering around 36%, and both the National and the Provincial Governments have initiated a number of plans aimed at creating conditions conducive for stimulating employment creation opportunities [1]. The Eastern Cape Provincial Government identified the establishment of a fibre agro-crop industry, e.g., flax, hemp and kenaf, as one such project that will help revitalise the agricultural potential of the province. The hemp imports (fibres, yarns and fabric) to South Africa for period of January – November 2003 amounted close to U$2million[2].

The dynamic world growth in the popularity of this high value cash crop has resulted in great interest in the crop from farmers, agricultural organisations, industries and co-operatives in South Africa. The commercial production of this crop is labour intensive, and has great potential for job creation in rural areas. However, the ethical complexity, limited knowledge and expertise in the production and processing of this crop make it difficult for farmers and other entrepreneurs to benefit from the increasing demand for hemp products.

It is this recognition of the economic opportunities presented by **hemp** for emerging farmers and industries alike that led to the launch of pilot initiative for hemp cultivation in the Eastern Cape Province in 1999/2000.

The Agriculture Research Council – Institute for Industrial Crops (ARC-IIC) and the Döhne Agricultural Development Institute were partners responsible for all the agronomic related activities, i.e., experimental design, planting, crop-care, harvesting and retting. For this purpose, four European hemp cultivars, namely; Novodsaska, Felina-34, Futura-77 and Kompolti were used in this research piloted at four sites in the province.

Retted hemp straw were sent to the CSIR for the determination of the fibre content of the cultivars grown under different agronomic experimental parameters, in order to evaluate their performance and cultivar adaptation to conditions in the Eastern Cape Province. The results are presented in this paper.

2 DESCRIPTION OF THE ACTUAL WORK

2.1 Experimental Agronomic

The agronomic trials were undertaken on plots located at the two agricultural research stations, i.e., Addo and Döhne as well as in two community sites (Libode and Qamata). At the Döhne research station the experimental trials were on:

- *spacing* and *density*, and on
- weed control, both using only Novodsaska.

The experimental trials at Addo and the two community sites focused on hemp cultivar adaptation and performance when planted a month apart, (see Table1).

TABLE 1. Agronomic experimental parameters for hemp cultivar pilot trials in the Eastern Cape Province

Experiment 1. Hemp spacing and density trial at Döhne		
Objective: Determination of optimum row spacing , seeding rate, and population density of hemp		
Cultivar	*Spacing factor (cm)*	*Density factor (kg)*
Novodsaska	S1 = 12.5	D1 = 50
	S2 = 25	D2 = 80
	S3 = 55	D3 = 110
Experiment 2: Weed Control trials at Döhne		
Objective : To identify and select suitable weedicide and weed control method on hemp		
Cultivar	*Treatment*	*Method*
Felina - 34 , Futura - 77 and Novodsaska	Chemical	Accotab, Basagran, Gallant Super, Afolan SC, Diuron, Frontier , and Dual S
	Non Chemical	Weed removal by hand
	Control	No weed removal
Experiment 3: Hemp cultivar adaptation trials Addo, Libode and Qamata		
Objective: To evaluate adaptation of hemp cultivars to Eastern Cape Province conditions		
Cultivar	*Seeding rate (kg) / hectare*	*Spacing (cm)*
Felina-34	50	25
Futura-77		
Novodsaska		

2.2 Fibre Extraction

Since hemp is a bast fibre crop, with the most valuable fibres contained within the bark of the stem, fibre extraction involves the separation of the bark from the core, a process known as decortication.
The fibres were removed using the hemp breaker-scutching unit available at the centre. A random sample of 20 retted hemp stems (Fig. 1) from each cultivar harvest grown under different agronomic parameters, were weighed and decorticated by crushing mechanism of the fluted steel rollers of the breaker.

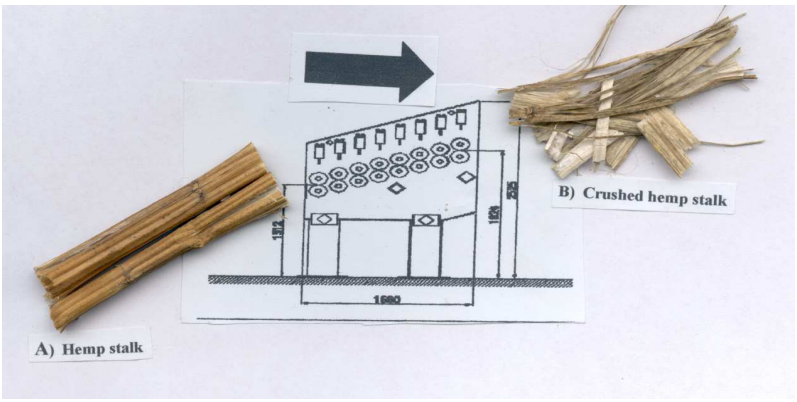

Fig. 1. Hemp breaker used to crush retted hemp stems.

After successive cycle of crushing of the retted stems from the same sample, a steel comb was further used to remove the plant debris still attached on the fibers. The weight of the sample fibres was then recorded in order to determine the total fibre content.

3 RESULTS AND DISCUSSIONS

The results of the total fibre content of *European* hemp cultivars grown under different agronomic experimental research conditions in the Eastern Cape Province to determine cultivar adaptability and performance are indicated for all the parameter used.

3.1 Experiment 1. Hemp spacing and density trial at Döhne

Spacing (S) and seeding rate (D) combination	% Yield
S1D1 = 12,5cm ; 50kg	23.65
S1D2 = 12,5cm ; 80kg	20.05
S1D3 = 12,5cm ; 110kg	20.43
S2D1 = 25,0cm ; 50kg	19.55
S2D2 = 25,0cm ; 80kg	21.53
S2D3 = 25,0cm ; 110kg	21.2
S3D1 = 50,0cm ; 50kg	23.05
S3D2 = 50,0cm ; 80kg	19.55
S3D3 = 50,0cm ; 110kg	23.05

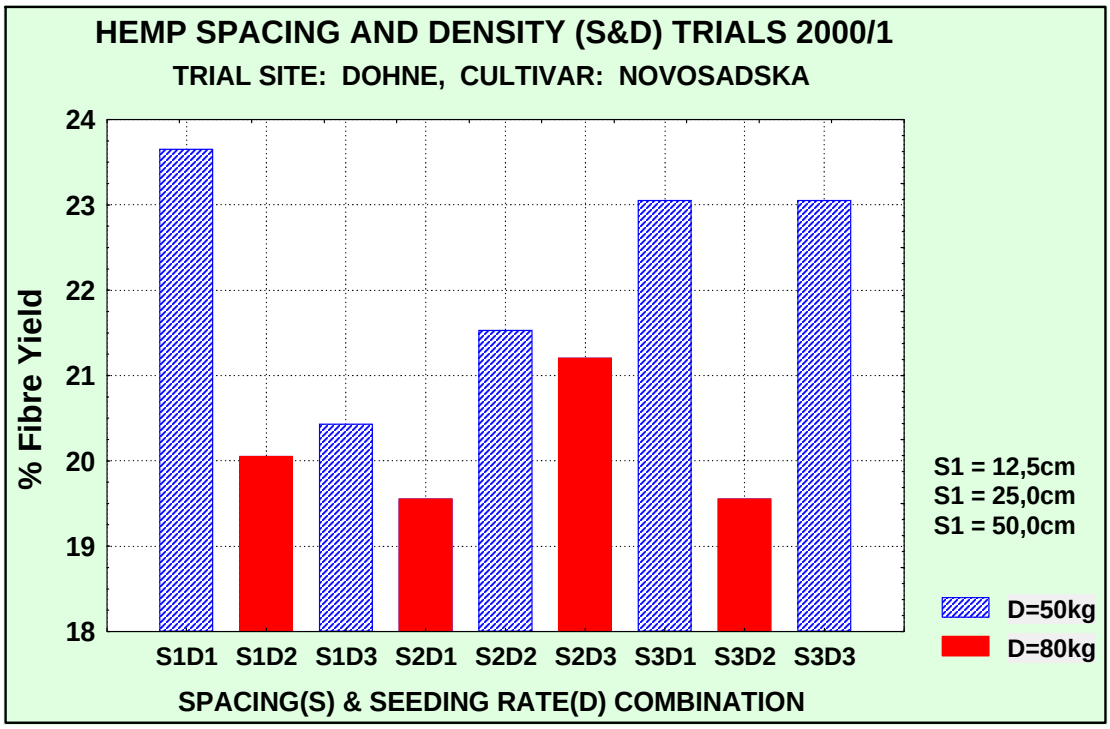

Fig. 2. Table and Graph on hemp spacing and density trials

There was marginal variation in the total fibre content ranging from around 19.55 to 23.65% within the same cultivar grown under different spacing and seeding rate. The S1D1 spacing and density combination showed a higher fibre percentage content compared to other combinations.

3.2 Experiment 2: Weed Control trials at Döhne

Treatment	% Yield		
	Novosadska	Felina-34	Futura-77
Accotab	23.1	22.1	21
Basagran	24.5	21.6	20.3
Gallant Super	25.2	20.1	22.3
Afalon SC	24	20.5	20.6
Diuron	21.3	20.3	22
Frontier	20.7	19.9	20.4
Dual S	21.1	22.6	23.1
Control (weeds by hand)	24.1	22	20.3
Control (no treatment)	22.3	21	21.4

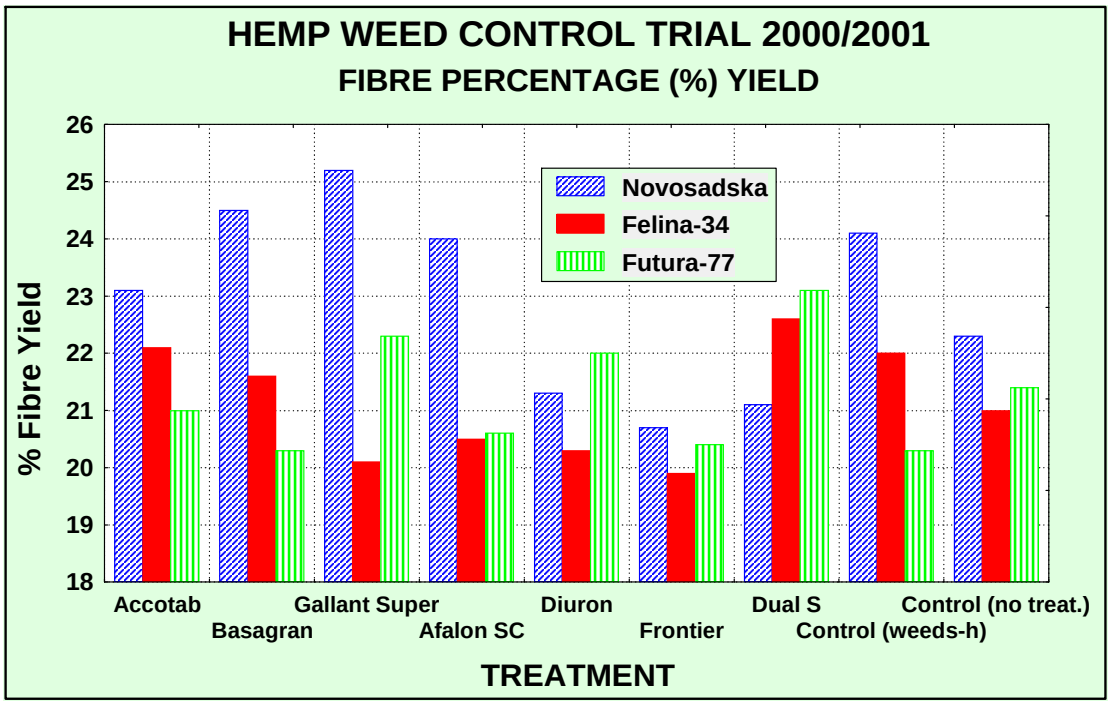

Fig.3. Table and graph on results of hemp weed control trials

The total fibre content of hemp cultivars grown under different weed control regime, i.e., chemical, mechanical and no treatment, ranged from 19.9 to 25.2%. The different cultivar performance was as follow:
Novosadska cultivar responded positively overall on most of the treatment regimes, except for Diuron and Dual, with the fibre percentage yield ranging from 20.7 to 25.2%.
Felina-34 fibre percentage yield to different treatment varied between 19.9 to 22.6%

Futura – 77 fibre percentage yield to different treatment varied between 20.3 to 23.1%

These values show no significant difference to the percentage fibre content between the chemically treated and untreated cultivars. The treatment seems not to influence the percentage fibre yield from different hemp cultivars if measured against the control experiments.

3.3 Experiment 3 : Hemp cultivar adaptation trials Addo, Libode and Qamata

HEMP CULTIVAR ADAPTATION TRIALS				
1st planting 2000				
CULTIVAR	**% Yield**			
	ADDO	DOHNE	LIBODE	QAMATA
Novosadska (Yoguslavia)	24.25	17.65	23.75	24.05
F - 34 (French)	21.75	16.96	23.6	24.25
F - 77 (French)	22.3	19.43	25	22.65
Kompolti (Hungarian)	21.075	16.50	25.75	22.7

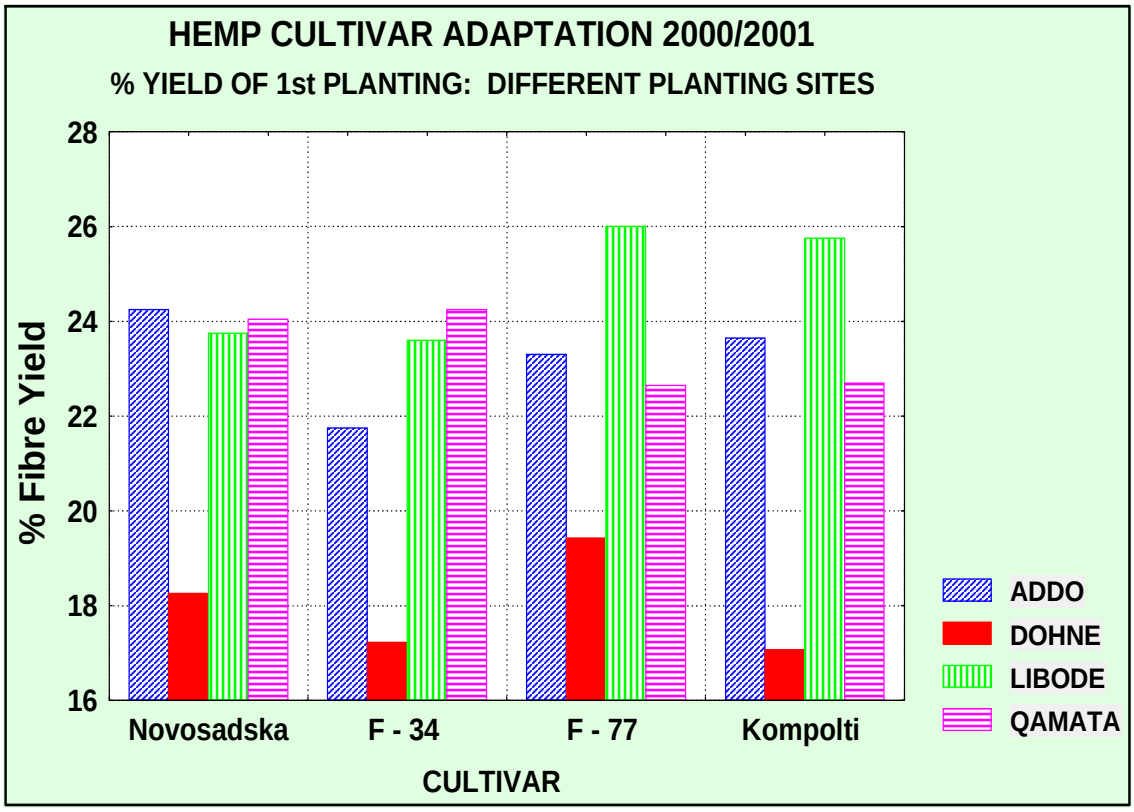

Fig. 4a. Table and graph of the result of hemp cultivar adaptation trials - 1st planting

HEMP CULTIVAR ADAPTATION 2000/2001				
2nd PLANTING				
CULTIVAR	FIBRE % YIELD			
	ADDO	DOHNE	LIBODE	QAMATA
Novosadska (Yogus)	22.8	17.5	25	22.4
F - 34 (French)	19.65	18.5	24.1	23.6
F - 77 (French)	22.35	19	25.3	22.35
Kompolti (Hungarian)	22.25	22.55	25.25	23.15

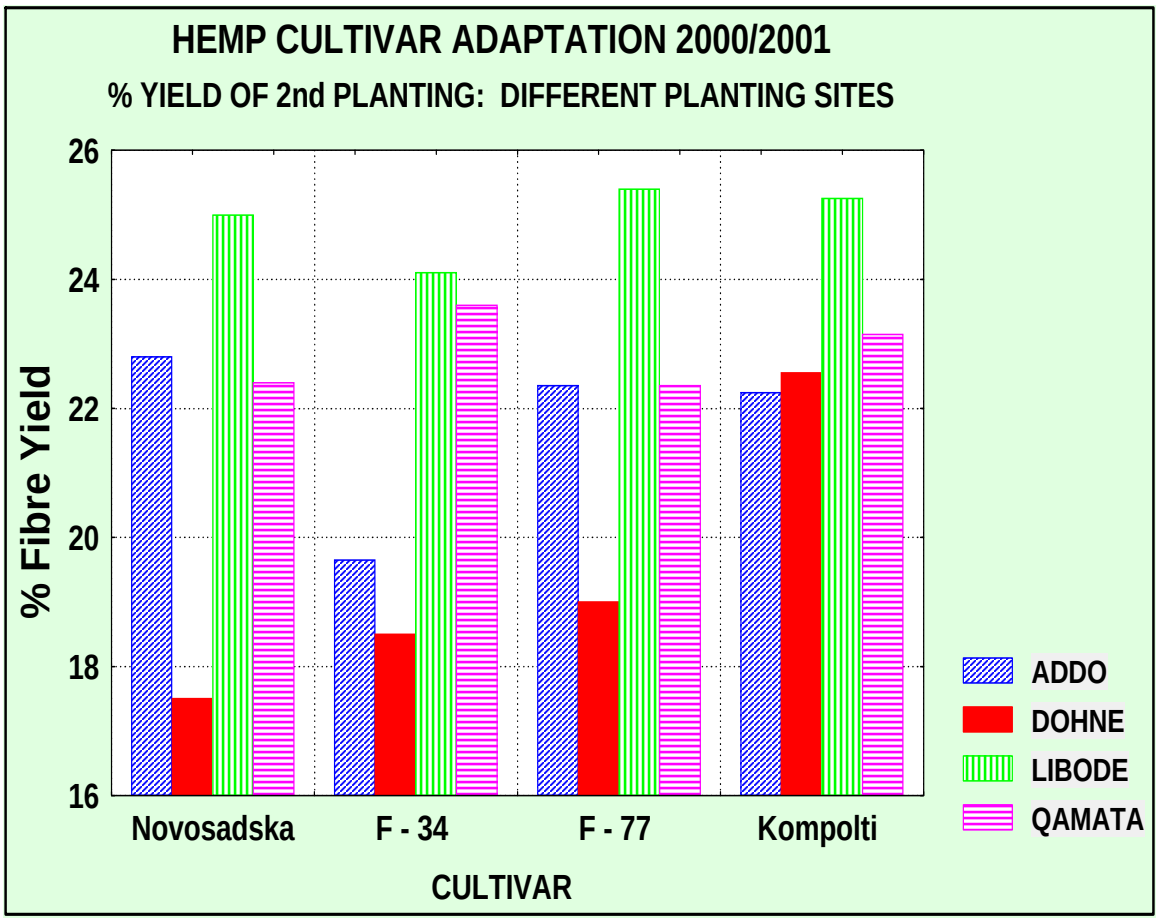

Fig. 4b. Table and graph on results of hemp cultivar adaptation trials – 2nd planting

A comparison on the effect of different sowing dates, a month apart, on the performance or adaptability of the hemp cultivars piloted in the Eastern Cape as measured against percentage fibre content determined by the decortication method ranged from 16.50 to 25.75.

There were no significant differences in fibre content percentages on comparing the performance cultivars grown on the same pilot site but sowed in different dates. The fibre

content results from Döhne pilot sites were lower for both sowing dates when compared to the other three sites, except for Kompolti which performed better in second sowing date.

4 CONCLUSIONS

The potential to develop hemp industry in South Africa was investigated by the cultivation of four different cultivars under different agronomic parameters.

This study shows that:

- Hemp can grow in South Africa and the total fibre content yield was comparable to that found in hemp growing countries.
- To achieve slender hemp straw that will yield high percentage of fibre content using minimum spacing and density combinations and thus resulting in ease in the decortication process, the spacing and density combination found to be appropriate was 12,5cm and 50kg respectively.
- The application of weedicide did not cause any improvement on the fibre content when compared to the untreated experiment.
- The appropriate time in the year suited for the cultivation of hemp in the Eastern Cape Province is in the October – November months.

5 FURTHER WORK

Further research on best farming practices on cultivation of hemp, i.e., crop care, harvesting methods and retting process by the agricultural research partners continues. Other cultivars from various sources in the world will be evaluated for their suitability for cultivation in the province and country.

The CSIR will continue to evaluate fibre properties (physical and chemical) of the different hemp cultivars as well as undertaking product developmental via spinning and nonwoven technologies.

6 ACKNOWLEGEMENTS

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