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Commercial farm trials with *Agaricus subfloccosus* (W4) and *Agaricus arvensis* (93-7) strains

CONTENTS

PRACTICAL SECTION FOR GROWERS

While the cultivated mushroom, *Agaricus bisporus*, continues to dominate commercial production, there are over 40 naturally occurring *Agaricus* relatives in the UK alone, offering a diversity in shape, texture, colour and flavour. Two in particular, the horse mushroom *(Agaricus arvensis)* and a brown woodland species *(Agaricus subfloccosus*) have been identified as having commercial potential due to their strong flavours, attractive fruitbodies and ability to grow under similar cultural conditions to *A. bisporus*.

A strain of horse mushroom (93-7) and a strain of *A. subfloccosus* (W4 IV 15) were successfully cultivated on a commercial scale in bags and trays, with yields similar to those obtained previously on an experimental scale. The market reaction to both strains was generally favourable, with price premiums being obtained relative to *A. bisporus*.

Optimum cropping temperatures for the two strains were identified: *A arvensis* 93-7 required a lower air temperature (15-16.5°C) than *A. subfloccosus* W4 IV 15 (17.5-18°C).

EXPERIMENTAL SECTION

INTRODUCTION

A wild *Agaricus* species (W4) with an attractive appearance and distinctive flavour, considered to be better than that of *A. bisporus*, has been identified as *Agaricus subfloccosus*. As a result of HDC Project M4a, a strain was isolated (W4 IV, single spore isolate 15) which is capable of producing 83% of the yield of commercial brown stains of *A. bisporus* on an experimental scale.

As part of Project M4a, the cropping performances of several isolates of horse mushroom *(A. arvensis)* were compared. The best isolate, collected from the wild in the UK, was 93-7.

The objective of the present project was to evaluate the cropping performance of W4 IV 15 and 93-7 on commercial farms in bag and tray culture, and to compare the results, where possible, with yields from strains of *A. bisporus* and a Dutch strain of *A. arvensis* (R20).

MATERIALS AND METHODS

Mushrooms were produced at five commercial farms (two tray farms and three bag farms) and, as a control, in the HRI mushroom unit (bags). Trays on Farm (a) contained 150 kg spawned compost; trays on farm (b) contained 220 kg spawned compost. All the bags contained 20 kg spawned compost. The number of crops and growing containers per crop are shown in Table 1.

General Culture

Standard Phase II mushroom compost, spawned at 2% w/w, was used on all the farms. Spawn-running time was 20-21 days, except on farm (e) where casing was delayed. Casing was applied to a depth of about 40 mm. On farms (b) and (d), a brown milled peat/chalk casing was used. Farm (c) and HRI used a wet dug peat/sugar beet lime casing and farm (a) used a mixture of Dutch ready mixed casing and brown milled peat. Watering on the farms was lighter than that used for *A. bisporus*.

Environmental conditions during spawn and case running and cropping are shown in Table 1. Compost temperature before airing was kept at 25-26°C. Air temperatures during cropping ranged from 15°C on farms (b) and (c) to 18.5°C on farm (a). On farms (a), (b) and (c) and HRI, the RH and CO_2 concentration during cropping were 90-93% and 600-800 ppm respectively. RH and CO_2 were not recorded on farms (d) and (e). On farms where *A. arvensis* was grown, ie. farms (a), (b), (c) and (e) and HRI, the room lights were kept on during cropping. The first mushrooms were picked about 26 days after casing.

RESULTS

Yield

Average yields and the number of flushes picked are shown in Table 2. Yields of *A. arvensis* (93-7) were better on farms where a lower cropping temperature was used (b, c and e) than on farm (a). Conversely, yields of *A. subfloccosus* W4IV15 were better on farms (a) and (d), where cropping temperatures were higher, than on farm (c).

The *A. arvensis* strains 93-7 and R20 were compared on farm (b). Total yield after 6 flushes (10 weeks) was 14% higher than 93-7, although picking commenced one week later. However, the duration from spawning to airing was 4 days shorter for 93-7 than for R20.

On farm (a), the mushrooms were picked as 'opens' (Figures 1 and 2). On farms (b), (c) and (e) and HRI, horse mushrooms were picked with closed caps (Figures 3 and 4).

On farm (d) and at HRI, the yields of W4IV15 were 63% and 52% respectively of a commercial white hybrid strain of *A. bisporus*. Mushrooms were picked as a mixed grade of buttons and opens.

The yields obtained for 93-7 and W4IV15 were similar to those obtained previously on an experimental scale (HDC Report M4a).

Quality and market reaction

A. arvensis (93-7). On farm (a), where mushrooms were picked as opens, there was insufficient distinction with large open *A. bisporus*. On farms where the mushrooms were picked closed (b, c and e), the market reaction was favourable, with a price premium being obtained compared with white *A. bisporus*. However, this did not fully compensate for the lower yield.

A. subfloccosus W4IV15. A price premium for W4IV15 over *A. bisporus* was also obtained, although this was insufficient to compensate for the lower yield. The quality of the mushrooms in terms of cleanness and shelf-life was generally good.

CONCLUSIONS

1. Both the horse mushroom (93-7) and a brown woodland mushroom (W4IV15) are suitable for commercial scale culture in trays and bags.

2. The cropping temperature requirement of W4IV15 is higher (17.5-18.5°C) than that of 93-7 (15-16.5°C).

3. *A. arvensis* (93-7) should be marketed as a closed mushroom, whereas W4IV15 can be marketed as a mixed grade.

4. The strain 93-7 produced a more rapid spawn and case-run and a higher yield after 6 flushes than the strain R20, but picking commenced one week later.

5. Both 93-7 and W4IV15 appear to have some commercial potential, but higher yielding strains (possibly 10-15% higher) would be needed, to make their cultivation economically competitive with *A. bisporus* culture.

RECOMMENDATIONS FOR FURTHER WORK

For the cultivation of the two wild *Agaricus* strains to be economic, a further yield increase is necessary, possibly 10-15%. This could be achieved by further investigation of cultural factors such as substrates and supplementation or by breeding.

A. subfloccosus is an 'in-breeding' species, and although wild isolates from Canada, France and Switzerland have been obtained, they cannot, as yet, be hybridized. However, the breeding system of *A. arvensis* enables isolates from different sources to be crossed. As part of a MAFF funded project, the hybridization of UK and different European isolates has been achieved. Hybridization with American isolates is now being attempted. It is possible that some of the progeny from these crosses will be higher yielding than 93-7. If such isolates are identified, their cultivation in farm trials should be examined.

Table 1. Cultural details and average environmental conditions for the cropping trials.

Farm	Growing System	Number of crops	No trays or bags per crop	Compost ** temp. °C	Air temp. °C	RH* %	CO_2* ppm	Days		
								Spawn-run	Casing to Airing	Airing to 1st pick
a	Trays	2	4	26	18.5	92	800	21	15	13
b	Trays	3	3	26	15	90-93	600	-	-	-
c	Bags	1	10	25	15	90-93	675	20	15	12
d	Bags	9	4	26	17.5	-	-	20	15	11
e	Bags	3	4	26	16.5	-	-	34	13	-
HRI	Bags	1	5	25	16	92	600	20	14	12

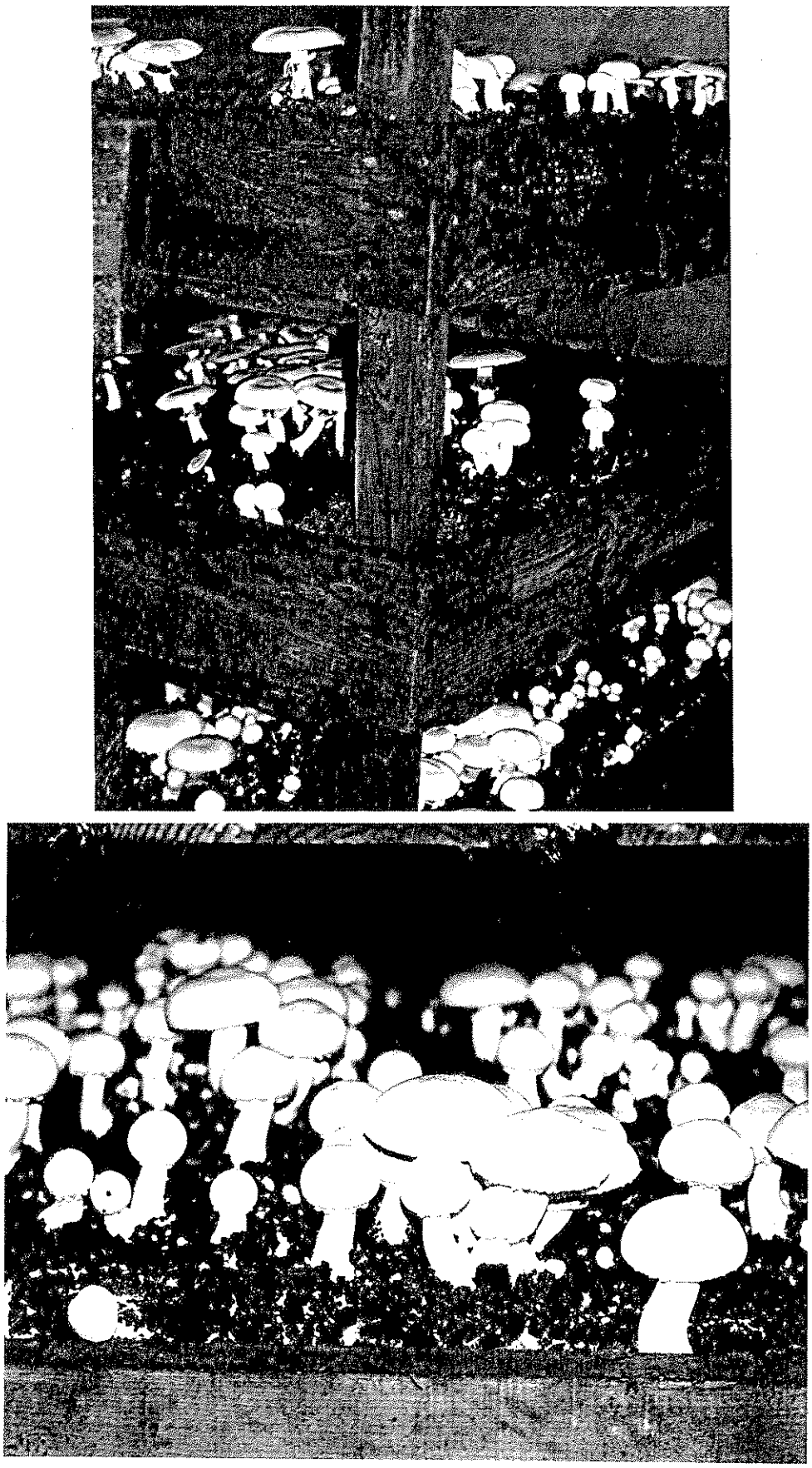
** During spawn and case run

* During cropping

Table 2. Yield of mushrooms, kg per tonne of spawned compost
The number of flushes picked are shown in parentheses

Farm	*A. subfloccosus* W4IV15	*A.arvensis* 93-7	*A. bisporus*	*A. arvensis* R20
a	145 (3)	73 (2)	-	-
b	-	174 (6)	-	152 (6)
c	81 (3)	136 (3)	-	-
d	154 (3)	-	245 (3)*	-
e	-	145 (2)	-	-
HRI	138 (4)	164 (4)	264 (4)**	-

* S501
** A12



Figs. 1 and 2.93-7 culture in trays on farm (a)

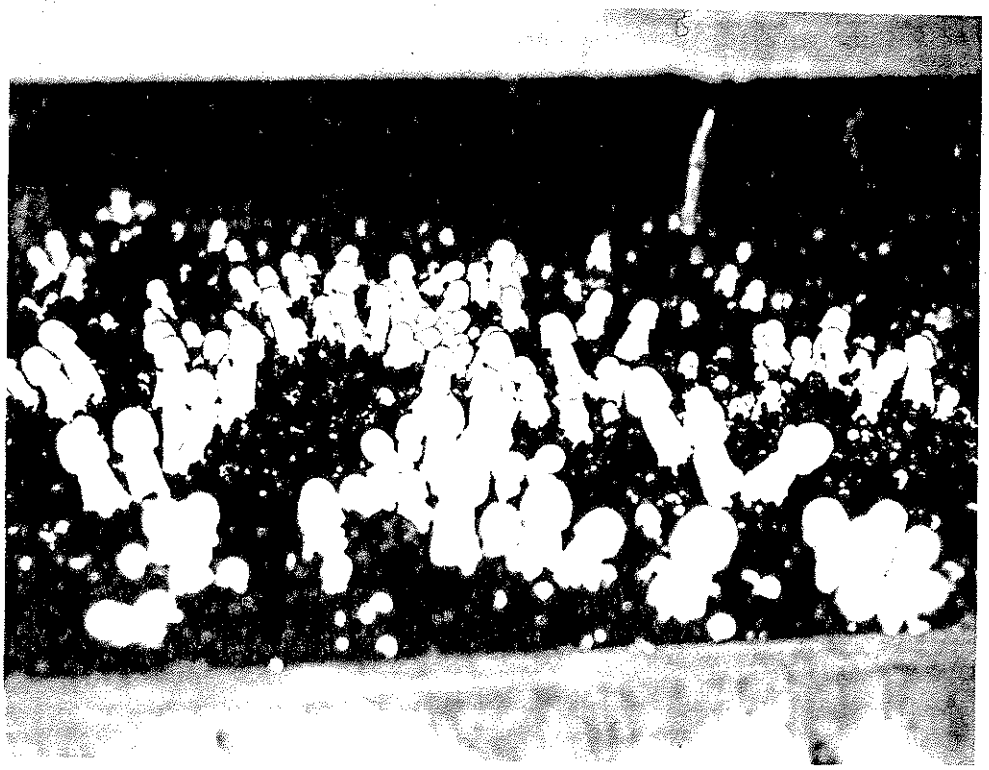


Fig. 3.93-7 culture in trays on farm (b)

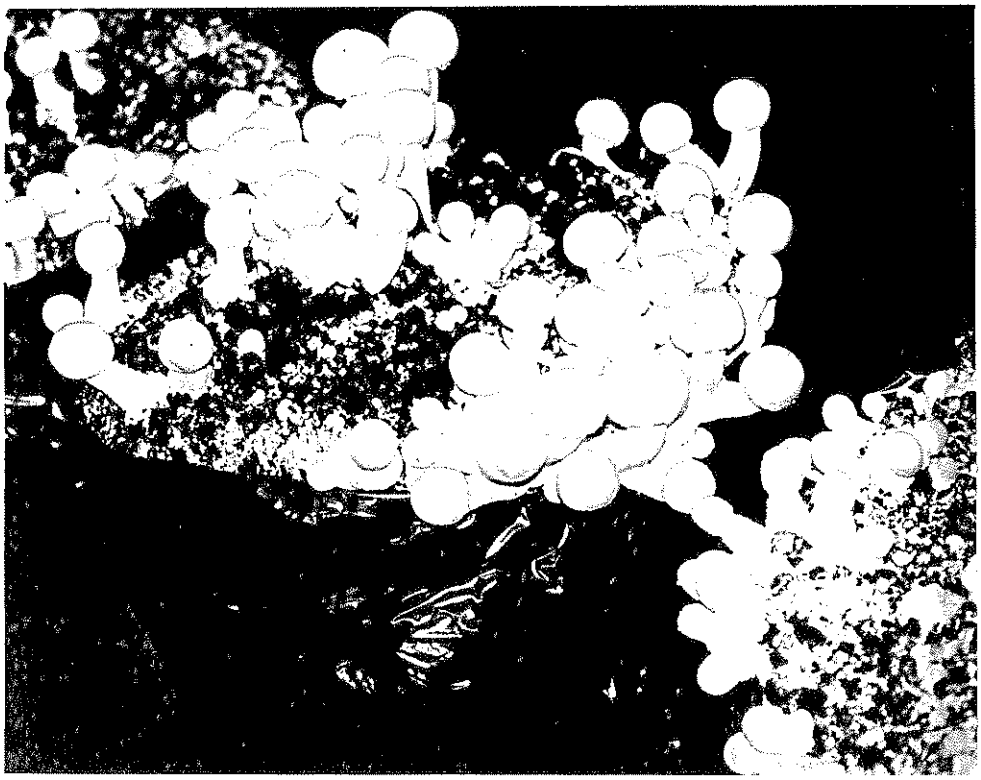


Fig. 4. 93-7 culture in bags on farm (c)