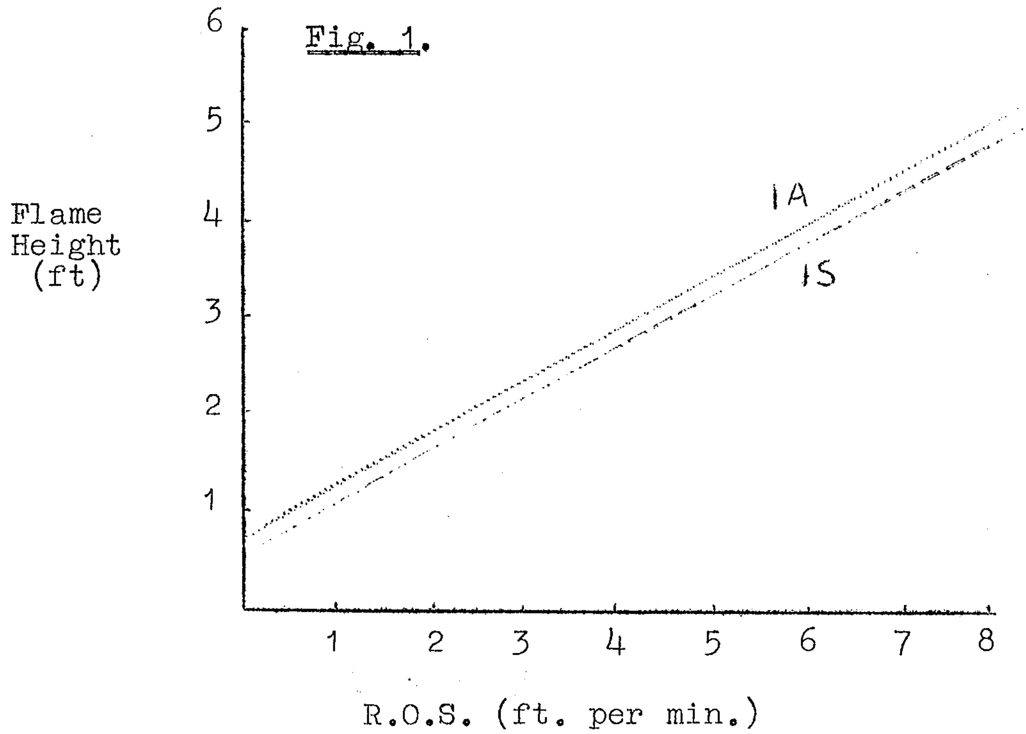
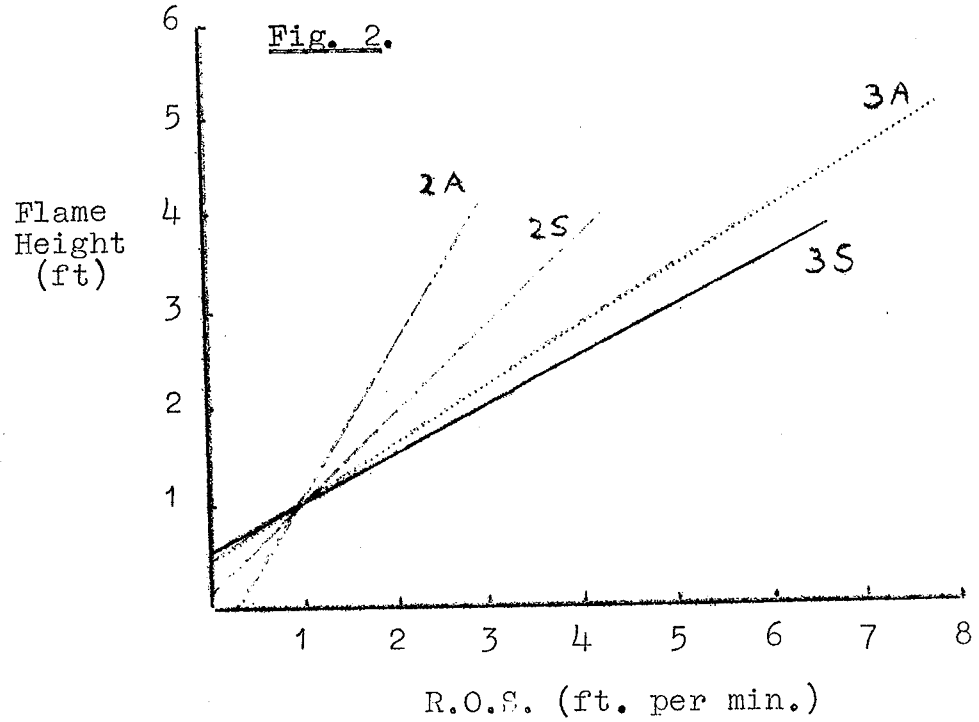
A FLAME HEIGHT - RATE OF SPREAD RELATIONSHIP IN THE NORTHERN JARRAH FOREST.

by J. McCormick.

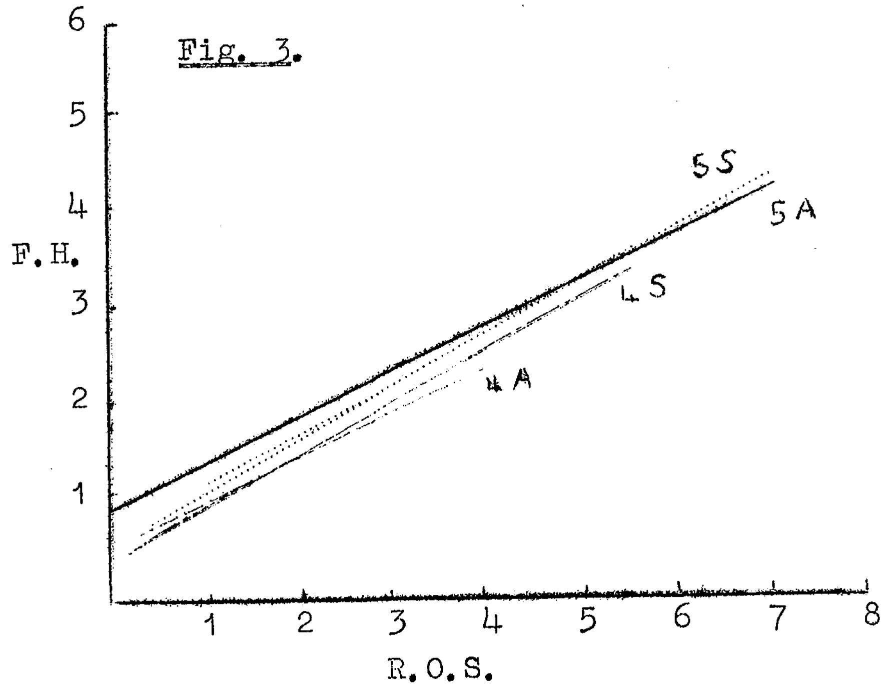


In the past three years 367 experimental fires have been run in the Northern Jarrah Forest, in and around Dwellingup division. Of these fires, 217 were Spring fires and the remaining 150 were Autumn fires. Headfire rates of spread were recorded at two minute intervals and flame heights taken at four minute intervals. From the resultant data, flame heights were plotted against rates of spread for both Autumn and Spring fires thus producing two linear curves 1A and 1S (fig. 1).

It will be observed that these curves run almost parallel to each other with the Autumn curve being the more dominant; thus indicating higher flame heights in Autumn throughout the entire R.O.S. range.



To find the effect of Wind speed on flame height the data was broken down into two wind speed classes, i.e. those fires whose wind speed was under 2 m.p.h. and those run in wind speeds of over 2 m.p.h. This gave the curves 2A:2S (under 2 m.p.h.) and 3A:3S (over 2 m.p.h.) respectively. (fig. 2.)



Here the wind speed effect is easily noticeable in comparing curves 2A:2S with 3A and 3S. In the lower wind speed class flame heights are higher throughout the entire R.O.S. range. Again we find the Autumn flame heights dominant in their respective wind speed classes; furthermore the Autumn dominance in flame height over Spring flame height increases with R.O.S. increase. In effect the angular difference between the lower and higher wind speed curves is an indication of the 'laying' of the flame by the wind.

In an attempt to find the effect of fuel quantity on flame height, the original data is taken out in Fuel quantity classes, i.e., all fires with less than 2 tons per acre and all fires with over 2 tons per acre. The resultant curves were 4A:4S ($<$ 2 TPA) and 5A:5S ($>$ 2 TPA) fig. 3.

Here we find the autumn flame heights dominant only in the higher fuel class and it would appear from these regressions that although Autumn flame heights are generally higher than Spring flame heights, seasonal change has little or less effect where the ground fuel available is less than 2 tons per acre. In comparing fig. 3 with fig. 1 there is also a noticeable drop in flame height with reduction in fuel quantity.

The combined effect of wind speed and fuel quantity is shown in the regressions (6A:6S ...... 9A:9S). Fig. 4 and Fig. 5.

In comparing curves 7A with 9A and 7 S with 9S (all over 2 TPA) the wind effect is pronounced as in Fig. 2. (i.e. lower wind speed, higher flame height) but when fuel quantity is introduced, the picture becomes more distorted 6A:6S and 8A:8S (all under 2 TPA); for example in Fig. 4 the Spring flame heights are higher than the Autumn flame heights where the wind speed is under 2 m.p.h. and where the wind speeds encountered are over 2 m.p.h. the Spring flame heights are again dominant but only when the R.O.S. is over approximately 2.5 ft. per min. Fig. 5; again indicating how little seasonal change influences flame height where low fuel quantities are encountered.

Fig. 4.

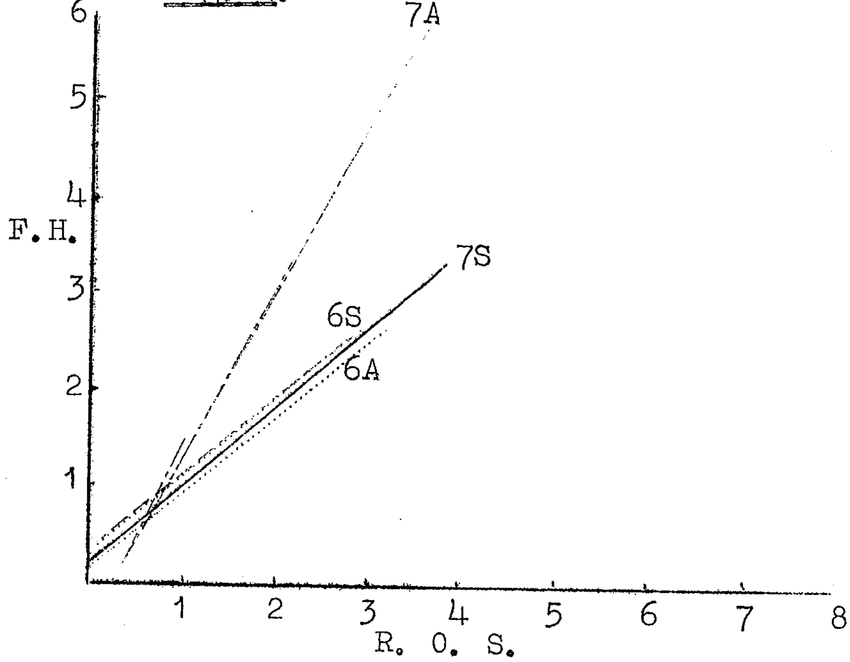
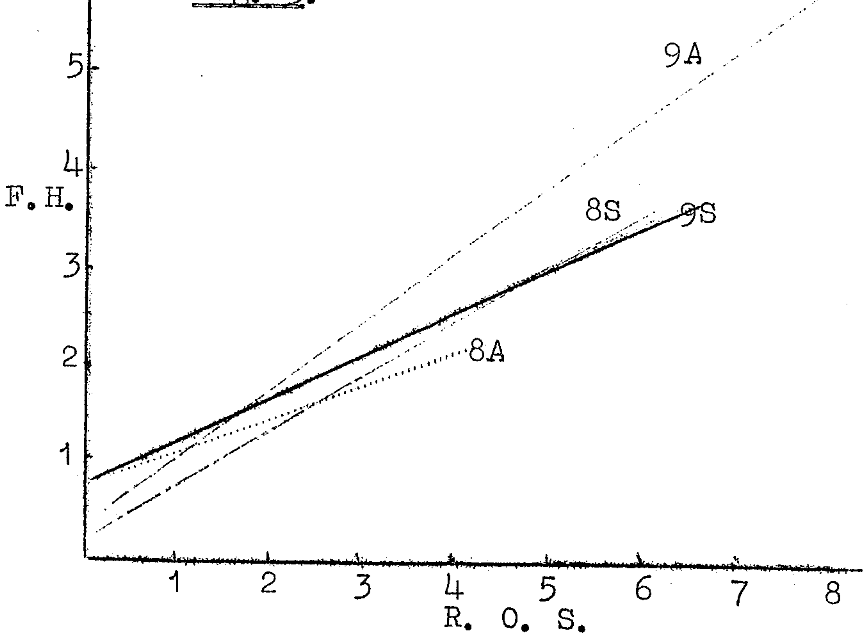


Fig. 5.



The regressions illustrated were :-

Spring Fires.

Reg. No.		r	t	sig.	N
1S	y = .558 + .5461x	.71	14.40	.01	217
2S	y = .1488 + .9284x	.75	10.00	.01	102
3S	y = .542 + .5165x	.74	11.40	.01	115
4S	y = .4639 + .5269x	.74	9.40	.01	75
5S	y = .598 + .544x	.55	7.79	.01	142
6S	y = .3539 + .8107x	.64	4.56	.01	32
7S	y = .241 + .8508x	.74	9.07	.01	70
8S	y= .2218 + .5728x	.82	9.17	.01	43
9S	y= .7294 + .473x	.68	7.75	.01	72

Autumn Fires.

Reg. No.		r	t	sig.	N
1A	y = .7 + .549x	.55	8.01	.01	150
2A	y = -.322 + 1.527x	.58	5.03	.01	52
3A	y = .486 + .609x	.50	5.62	.01	97
4A	y = .537 + .474x	.67	5.02	.01	45
5A	y = .931 + 477x	.52	7.20	.01	104
6A	y = .194 + .809x	.82	6.72	.01	24
7A	y = -.514 + 1.871x	.56	11.10	.01	29
8A	y = .704 + .371x	.50	2.34	.05	21
9A	y = .335 + .717x	.56	7.03	.01	77