Composition variability of spent mushroom compost (SMC) in Ireland

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Introduction

Spent mushroom compost (SMC) is a nutrient-rich organic by-product of the mushroom industry. Irish mushroom growers produce an estimated 295,000 tonnes of SMC annually (Anon., 2001) and this poses a serious environmental challenge. It is generally acknowledged that SMC is an attractive material for improving soil structure in tilled soils (Maher *et al.* 2000, amongst others) and increasing dry matter production on grassland soils (Mullen and McMahon, 2001). As 72% of all SMC in Ireland is applied to land (Maher *et al.* 2000), it is therefore imperative that systematic analysis should be carried out on its composition in order to evaluate the merit of SMC as a fertiliser. The main objective of this research was to investigate the variability of the composition of SMC both in Northern and the Republic of Ireland, in relation to selected physical and chemical parameters.

Materials and Methods

Spent mushroom compost was collected from mushroom production units supplied with compost by each of the composting yards in the North (5 yards) and the Republic of Ireland (8 yards). One bag of SMC was chosen randomly from each of five growers supplied by each yard. The total number of bags of SMC collected and analysed was 63 as only four growers could be contacted for two of the yards. A 20cm wide segment of compost extending from the surface to the bottom of the bag, was cut along the diameter of each bag and removed for analysis. These samples were then mixed thoroughly by hand, air dried for one week, shredded and then stored awaiting further analysis. Sub samples of this material were obtained by further treatment and sieving as required to determine the parameters presented in Table 1. The data were then analysed statistically by analysis of variance and Pearson's bivariate rank correlations using the Anova programme of SPSS.

Results and Discussion

The overall results are outlined in Table 1. There were significant differences ($P<0.05$) between the entire compost production yards for the following parameters; pH, organic matter, total N, P and K, plant available P and K, C : N ratio, EC, lignin and the total elements Cu, Zn, Mn, Cd, Ni, Ca, Mg and Na. More specifically, compost obtained from the Northern Ireland producers showed significant differences ($P<0.05$) between yards for the parameters; EC, % lignin, the elements Cu, Zn, Mn, Ni, Ca and Mg and additionally total P, available P, total K, available K and total N. In comparison to yards in the Republic of Ireland, similar differences were observed between the various yards ($P<0.05$); with the exception of total N and P. In addition the total Na and organic matter levels also differed considerably between yards. The majority of the nutrient data determined were in agreement with those observed by Maher et *al.* (2000) in 13 SMC samples in Ireland, with the notable exceptions of total N, P, Ca, Na, Cu, EC and % dry matter that were considerably higher and total K and Ca levels that were appreciably lower. With high salt concentrations, probably due to the elevated Mg and K levels, and possible toxicities arising from Cu concentrations in two particular yards, potential problems could arise when SMC is used as amendment to soil, in particular when applied to tilled land growing salt sensitive crops. Cd, an element that is only needed in small concentrations for plant growth was also in excess of standards outlined by Hogg *et al.* (2002). There was a strong correlation between EC and total and plant available K ($r = 0.79$, $P<0.01$), which suggests that K may be primarily responsible for the high salt levels. Overall, it is important to be assured that the SMC will offer 'value for money' in terms of the adequate supply of plant nutrients and therefore systematic reliable information regarding SMC composition from each production yard must be available for assessing this value.

Table 1 Minimum, maximum, mean and standard deviation of selected parameters on SMC.

Parameter	Min	Max	Mean	S.D.
Dry Matter %	21	51	31	4.6
*Organic Matter %	41	76	64	5.9
pH	6.0	7.9	6.8	0.48
*Available P g/kg	1.3	25	4.0	3.80
*Total P g/kg	11	38	18	5.8
*Available K g/kg	8.0	21	13	2.90
*Total K g/kg	11	34	20	6.2
*Total N g/kg	17	28	21	2.0
*C : N ratio	14	24	18	2.0
*EC mS/cm	6.8	15	10	1.82
*Total Ca g/kg	55	53	34	10.8
*Total Mg g/kg	9.4	21	14	2.78
*Total Na g/kg	0.39	42	11	9.526
*Lignin %	11	49	25	9.5
*Cellulose %	18	62	38	8.6
*Hemicellulose %	2.0	41	19	8.71
*Total Cu mg/kg	17	106	54	21.2
*Total Zn mg/kg	58	284	143	39.2
*Total Mn mg/kg	32	328	164	36.5
*Total Fe mg/kg	2.4	9.0	4.7	0.95
*Total Pb mg/kg	7.3	15.6	10.4	1.69
*Total Cd mg/kg	0.40	8.2	6.2	1.180
*Total Cr mg/kg	0.21	0.31	0.21	0.010
*Total Ni mg/kg	5.8	5.8	5.8	0.02

** Based on dry weight*

Conclusion

While SMC has been proven to be a material of substantial fertiliser value, its variability in composition is of particular importance especially with the recent emphasis on plant nutrient management in agriculture.

References

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