CLAIMS

What is claimed is:

1. A method for reducing methylation of a target nucleic acid in a plant, comprising:

(a) providing a plant comprising a recombinant methylcytosine dioxygenase polypeptide that is a Ten-eleven translocation (TET) polypeptide and comprises the amino acid sequence of SEQ ID NO: 189; and

(b) growing the plant under conditions whereby the recombinant polypeptide is targeted to the target nucleic acid, thereby reducing methylation of the target nucleic acid as compared to a corresponding control nucleic acid.

2. The method of claim 1, wherein the recombinant methylcytosine dioxygenase polypeptide is targeted to the target nucleic acid via a SunTag targeting system.

3. The method of claim 1, wherein the recombinant methylcytosine dioxygenase polypeptide is targeted to the target nucleic acid via a DNA-binding domain.

4. The method of any one of claims 1 to 3, wherein the TET polypeptide is a TET1 polypeptide.

5. The method of claim 4, wherein the TET1 polypeptide comprises the catalytic domain of TET1.

6. The method of claim 1, wherein expression of the target nucleic acid is activated as compared to a corresponding control nucleic acid.

7. A recombinant nucleic acid comprising a plant promoter and which encodes a recombinant polypeptide comprising a DNA-binding domain and a methylcytosine dioxygenase polypeptide that is a TET polypeptide and comprises the amino acid sequence of SEQ ID NO: 189.

8. An expression vector comprising the recombinant nucleic acid of claim 7.

9. A host cell comprising the expression vector of claim 8.

10. A recombinant plant comprising the recombinant nucleic acid of claim 7.

11. A recombinant vector comprising:

-a first nucleic acid sequence comprising a plant promoter and that encodes a recombinant polypeptide comprising a nuclease-deficient CAS9 polypeptide (dCAS9) or fragment thereof and a multimerized epitope;

-a second nucleic acid sequence comprising a plant promoter and that encodes a recombinant polypeptide comprising a methylcytosine dioxygenase polypeptide that is a TET polypeptide and comprises the amino acid sequence of SEQ ID NO: 189, and an affinity polypeptide that specifically binds to the epitope; and

-a third nucleic acid sequence comprising a promoter and that encodes a CRISPR RNA (crRNA) and a trans-activating CRISPR RNA (tracrRNA), or fusions thereof.

12. A host cell comprising the vector of claim 11.

13. A recombinant plant comprising the vector of claim 11.